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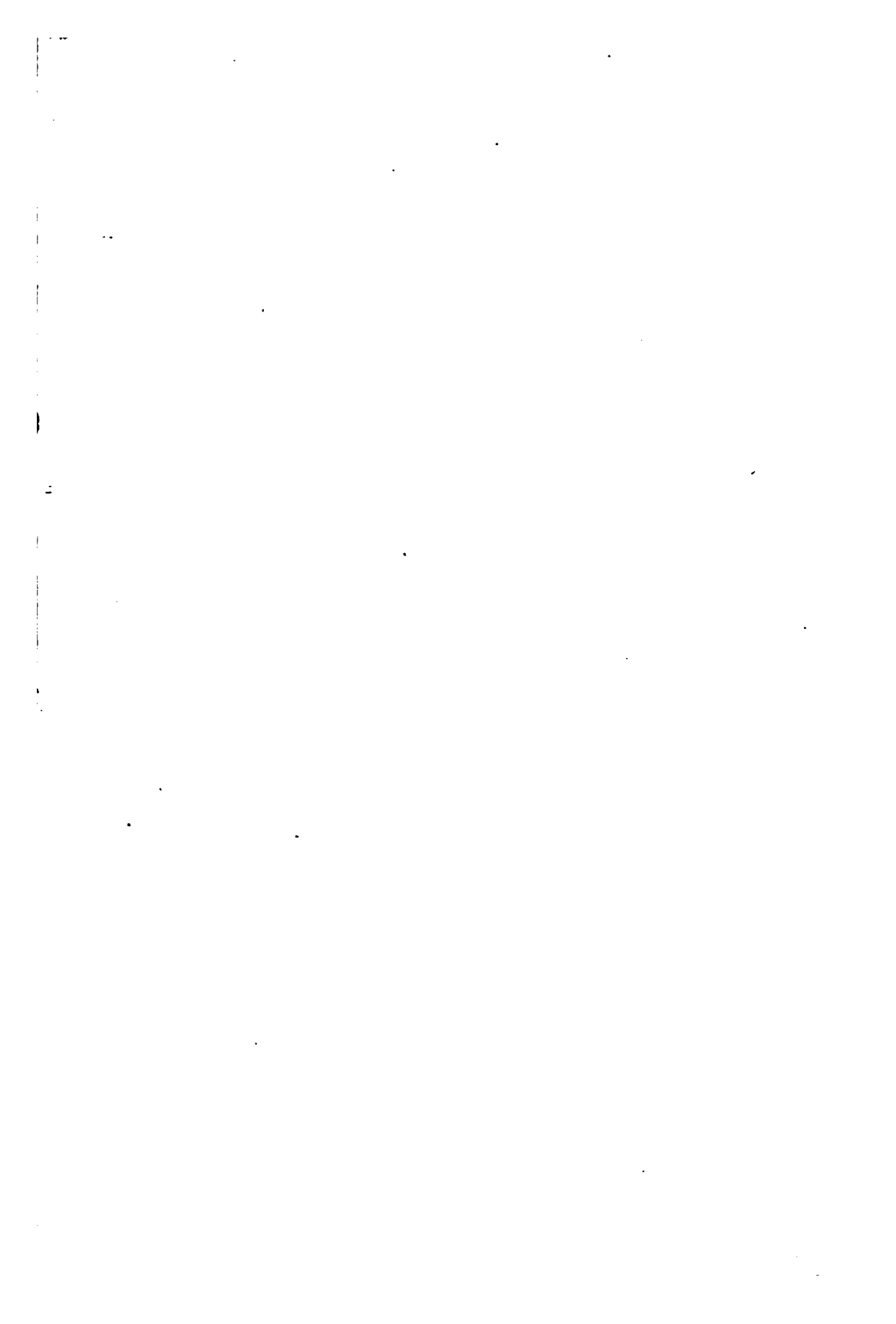
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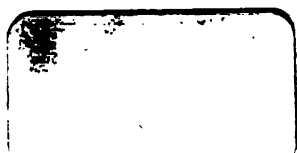
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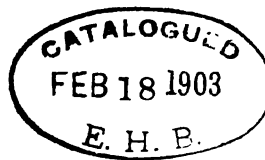
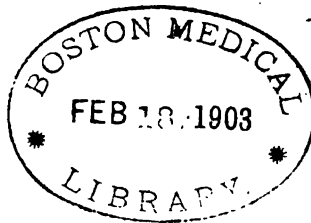
BY

JOHN M. SWAN, M. D.

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 Butler, Margaret F., 2127 Green
 Butt, Miriam M., 1509 Poplar

C

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 Caldwell, Alex., 1904 Christian
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 Tacony
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 Krauss, Frederick, 930 Franklin
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Kyle, E. Bryan, 2821 Frankford Ave.
 Kynett, H. H., 614 S. 48th

L

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 Leach, W. W., 2118 Spruce
 Leaman, A. H., 832 N. Broad
 Leaman, Rosh, 1818 Girard Ave.
 Leamy, L. J., 33d and Spring Garden
 Leconte, R. G., 1530 Locust
 Lee, Benjamin, 241 W. Seymour St.,
 Germantown
 Le Fever, Chas. W., 1708 Pine
 Leffmann, Henry, 119 S. 4th
 Leidy, Joseph, 1319 Locust
 Leof, M. V., 495 N. 4th
 Leonard, C. L., 112 S. 20th
 Leopold, Isaac, 1518 Franklin
 Levi, I. Valentine, 1733 N. 16th
 Lewis, Bertha, 1831 Chestnut
 Lewis, M. J., 1316 Locust
 Liggett, Samuel J., 936 W. Somerset
 Lincoln, C. W., Coulter and Wayne,
 Germantown
 Litch, W. F., 1507 Walnut
 Lloyd, J. H., 3918 Walnut
 Lockrey, Sarah H., 1520 Vine
 Loder, P. E., 517 S. 8th
 Loeb, Ludwig, 1421 N. 15th
 Loeb, Victor A., 957 N. 8th
 Longaker, D., 645 N. 8th
 Longenecker, C. B., 3512 Hamilton
 Longenecker, Jerome, 3409 Spring
 Garden
 Longstreth, Morris, 1416 Spruce
 Lopez, J. H., 126 N. 17th
 Lott, William C., 4001 Walnut
 Loux, H. R., 1941 N. 12th
 Love, L. F., 1225 Walnut

M

McAllister, Anna, 3503 Baring
 McArllarney, W. M., 1426 Poplar

McCamy, R. H., 1932 E. Cumberland
 McCarthy, Jas. D., 1342 Pine
 McClelland, Cochran, 316 S. 11th
 McClellan, George, 1352 Spruce
 McCollin, S. M., 1823 Arch
 McCreight, Robert N., 1340 E. Mont-
 gomery Ave.
 McDowell, N. S., 1810 N. 16th
 McDowell, S. B., 925 N. Broad
 McFarland, Jos., 442 W. Stafford St.,
 Germantown
 McGuigan, John I., 6018 Drexel Road
 McKee, James H., 1519 Poplar
 McKelway, John I., Philadelphia Hos-
 pital, 34th and Pine
 McKenna, John A., Lansdowne, Pa.
 McLean, Hugh D., 1331 Pine
 McLean, J. D., 1519 Christian
 McLoughlin, John J., 1532 S. 5th
 McReynold, Robert P., 3722 Walnut
 MacBride, Isaac, 1761 Frankford Ave.
 MacCoy, A. W., 1338 Walnut
 Macintosh, James W., 1144 Jackson
 Maier, F. H., 2242 N. Broad
 Makuen, G. H., 1419 Walnut
 Manasses, Jacob L., 2501 North 32d
 Mann, James P., 1234 Spring Garden
 Marshall, Clara, 1712 Locust
 Marshall, George M., 1819 Spruce
 Martin, Collier Ford, 1831 Chestnut
 St., Room 601
 Martin, Edward, 415 S. 15th
 Martin, Joseph, 2009 Columbia Ave.
 Masland, H. C., 2134 N. 19th
 Massey, G. B., 1831 Chestnut
 Mathews, Franklin, 1720 N. 22d
 Mayo, Florence, 414 W. Huntingdon
 Mays, T. J., 1829 Spruce
 Meigs, A. V., 1322 Walnut
 Metzler, Gottfried, 949 Franklin
 Miller, D. J. Milton, 345 S. 18th
 Miller, G. B., 634 Diamond
 Miller, M. B., 414 S. 15th
 Miller, Mary T., 313 N. 33d
 Milliken, F. H., 3614 Walnut
 Mills, Charles K., 1909 Chestnut
 Mills, H. Brooker, 2263 N. 21st
 Mitchell, John K., 256 S. 15th
 Mitchell, S. W., 1524 Walnut
 Mitcheson, Robert S. J., 1522 N. 15th
 Modell, Daniel A., 514 N. 4th
 Montgomery, E. E., 1703 Walnut
 Moore, C. C., 2349 E. Cumberland
 Moore, Edward J., 1902 N. 23d
 Moore, H. D., 1528 Tasker
 Moore, John D., 1505 N. 19th
 Moorhead, W. W., 1523 Pine
 Morehouse, George R., 2033 Walnut

Morgan, Arthur C., 3014 Diamond
 Morris, Caspar, 2050 Locust
 Morris, E. J., 128 S. 18th
 Morris, Henry, 313 S. 16th
 Morris, J. C., 1514 Spruce
 Morrison, W. H., Holmesburg, Pa.
 Morton, G. D., 2048 Locust
 Morton, Thomas S. K., 1506 Locust
 Moss, William, Main and Chestnut
 Ave., Chestnut Hill
 Mossell, N. F., 1432 Lombard
 Moulton, A. R., Pennsylvania Hos-
 pital, Department for the Insane,
 49th and Market
 Moylan, J. J., 228 E. Price St., Ger-
 mantown
 Moylan, P. F., 1005 N. 6th
 Mudgett, John Herbert, 2039 Colum-
 bia Ave.
 Müller, A. F., 5429 Greene
 Müller, George P., Care of German
 Hospital, Girard and Corinthian
 Aves.
 Müller, R. E., 2002 S. 12th
 Munich, A. K., 145 Susquehanna Ave.
 Musser, J. H., 1927 Chestnut
 Musson, Emma E., 213 S. 17th
 Mutchler, L. H., 2030 Tioga
 Myers, T. D., 1722 Walnut

N

Nash, Joseph D., 1316 N. 11th
 Nassau, C. F., 1515 Wallace
 Neff, Joseph F., 2300 Locust
 Neilson, Thomas R., 122 S. 17th
 Neuber, S. T., 1855 Frankford Ave.
 Newbold, H. A., 3907 Walnut
 Newcomet, W. S., 3501 Baring
 Newmayer, Sol. W., 638 Spruce
 Newton, Robley D., 1504 Arch
 Nightingale, H. B., 247 N. 6th
 Noble, C. P., 1509 Locust
 Noble, Wm. H., 2101 N. 13th
 Nock, Thomas O., 821 N. 24th
 Numbers, W. A., 803 N. 8th

O

O'Daniel, A. A., 1225 Walnut
 Off, Henry J., 121 S. 18th
 O'Hara, M., 227 S. 20th
 O'Hara, M., Jr., 42 S. 19th
 Oliver, C. A., 1507 Locust
 O'Malley, J. M., 2217 S. Broad
 O'Reilly, Charles, 2025 Chestnut
 Ott, Lambert, 1531 N. 17th
 Ottinger, Samuel J., 12th and Master
 Owen, J. J., 411 Pine

P

Packard, F. R., 1831 Chestnut
 Packard, J. H., 517 Chestnut
 Page, Henry F., 1907 Girard Ave.
 Paist, Henry C., 536 N. 7th
 Pancoast, Henry K., 118 N. 34th
 Pancoast, J. William, 1611 N. 13th
 Parish, Wm. H., 2109 Chestnut
 Parke, Wm. E., 1739 N. 17th
 Patterson, F. W., 1503 Locust
 Patterson, Howard, 936 W. Lehigh Ave.
 Pearce, F. C., 1407 Locust
 Pearson, J. S., 1507 Christian
 Peck, Elizabeth L., 819 N. 40th
 Pennebaker, Benjamin, 4862 Tacony
 Pennock, W. J., 1422 N. 17th
 Penrose, C. B., 1720 Spruce
 Pepper, Wm., 1811 Spruce
 Perkins, F. M., 1428 Pine
 Peter, L. C., 2136 Oxford
 Pfahler, G. E., 1409 Spruce
 Phillips, J. L., 2213 Tioga
 Phillips, Horace, Pennsylvania Hospital, Department for the Insane, 49th and Market
 Phillips, James R., 1515 S. 6th
 Phillips, R. J., 123 S. 39th
 Pickett, William, 1308 N. 4th
 Piersoll, G. A., 4724 Chester Ave.
 Pilkington, Horatio, 4238 Paul St., Frankford
 Pitfield, R. L., 5211 Wayne Ave.
 Plass, Chas. F. W., Cor. Chew and Chelten Ave., Germantown
 Pontius, Paul J., 1829 Chestnut
 Porter, William G., 1118 Spruce
 Posey, Wm. Campbell, 1835 Chestnut
 Potsdamer, Jos. B., 1333 Franklin
 Pottburg, Charles, 2338 N. Broad
 Potts, B. H., 1516 Locust
 Potts, Charles S., 1726 Chestnut
 Prendergast, M. F., 2435 Columbia Ave.
 Price, Joseph, 241 N. 18th
 Price, Mordecai, 1335 Spring Garden
 Purnell, Caroline M., 132 S. 18th
 Pyle, W. L., 1806 Chestnut

R

Radcliff, McCluney, 711 N. 16th
 Rainear, A. R., 2024 Diamond
 Ramsay, Alex., 103 E. Lehigh Ave.
 Ramsay, Robt. N., 1124 S. 46th
 Randall, B. Alexander, 1717 Locust
 Ransley, A. W., 1315 S. Broad

Ravenel, Mazyeh P., Veterinary Department, University of Pennsylvania, 39th and Woodland Ave.
 Reber, Wendell, 1212 Spruce
 Reckefuss, Chas. H., Jr., 506 N. 6th
 Reed, Boardman, 1831 Chestnut
 Reeves, J. H., 1507 Walnut
 Regar, H. K., 1909 N. 13th
 Rehfuess, E. G., 1316 S. Broad
 Rehm, Victor G. R. J., 2008 Master
 Reynolds, Anna M., 1534 Dauphin
 Reynolds, J. P., 705 Spruce
 Rhein, J. H. W., 334 S. 15th
 Rhoads, E. J., 159 W. Coulter St., Germantown
 Rhoads, J. N., 1635 S. Broad
 Rhoads, T. L., Boyertown, Bucks Co.
 Riesman, David, 326 S. 16th
 Righter, H. M., 1324 S. 5th
 Ring, G. O., 1442 N. 13th
 Risley, Samuel D., 1824 Chestnut
 Roberts, John B., 1627 Walnut
 Roberts, Norman, 5141 Race
 Roberts, Walter, 33 S. 19th
 Robertson, J. F., 2465 N. 31st
 Robertson, William E., 912 N. 4th
 Robinson, George, 2215 N. 16th
 Robinson, Wm. D., 2012 Mt. Vernon
 Rocap, William A., Olney, Phila.
 Roderer, John F., 2426 N. 6th
 Rodman, Wm. L., 1626 Spruce
 Roe, W. J., 320 S. 11th
 Rosenthal, Edwin, 517 Pine
 Ross, George G., 1721 Spruce
 Rottner, Chas. R., 1500 N. 7th
 Roussel, A. E., 2112 Pine
 Rugb, J. T., 348 S. 15th
 Runkle, Stuart C., 1605 Christian
 Ruoff, Wm., 1301 N. 13th

S

Sailer, Joseph, 248 S. 21st
 Sajous, Charles E., 2043 Walnut
 Salade, L. A., 4000 Spruce
 Salinger, Julius L., 115 S. 16th
 Santee, E. J., 532 N. 6th
 Sartain, Paul J., 212 W. Logan Square
 Saylor, Edwin S., 1602 N. 16th
 Schaffer, Chas., 1309 Arch
 Schamberg, Jay F., 1636 Walnut
 Schamberg, Morris I., 1636 Walnut
 Schell, J. Thompson, 2505 N. 17th
 Schneideman, T. B., 1831 Chestnut
 Schoales, Chas. B., 1428 N. 11th
 Schwenk, P. N. K., 810 N. 7th
 Scott, J. Alison, 1834 Pine

Scull, Wm. B., 3024 Richmond
 Seabrook, Alice M., 2301 S. Broad
 Seiss, Ralph W., 255 S. 17th
 Seltzer, C. M., 2001 Green
 Service, Chas. A., City Line and Belmont Ave., Bala
 Sharp, Leedom, 2038 S. 13th
 Sharpless, Anna P., 3926 Chestnut
 Shea, William K., 1705 N. 18th
 Shellenberger, J. R., 5505 Main St., Germantown
 Shober, J. B., 1731 Pine
 Shoemaker, Geo. E., 3727 Chestnut
 Shoemaker, J. V., 1519 Walnut
 Shoemaker, Wm. T., 2031 Chestnut
 Shumway, Ed. A., 2007 Chestnut
 Shute, Harry A., 2145 Howard
 Simcox, Lawrence, 5201 Ridge Ave.
 Simes, J. H. C., 2033 Chestnut
 Simsohn, Joseph S., 909 Franklin
 Sinexon, Justus, 114 S. 18th
 Sinkler, Wharton, 1606 Walnut
 Siter, E. H., 2038 Locust
 Skidelsky, Rachel, 708 N. 16th
 Skillern, P. J., 241 S. 13th
 Skillern, Ross H., 3509 Baring
 Skillern, S. R., 3509 Baring
 Skilling, M. K., 1635 Christian
 Slaughter, Charles H., 1332 S. 10th
 Slocum, H. A., 1900 Chestnut
 Small, William B., 2232 Green
 Smith, A. D., 6019 Germantown Ave.
 Smith, S. Maccuen, 1700 Walnut
 Smitheman, Edward, 3510 Hamilton
 Smock, L. P., 3330 Chestnut
 Snively, I. N., 1617 N. Broad
 Snively, R. D., 1707 Tioga
 Somers, Lewis S., 3554 N. Broad
 Spellissy, Joseph M., 110 S. 18th
 Spencer, George W., 1838 Christian
 Spiegle, Grace E., 2115 N. 12th
 Spiller, William G., 4409 Pine
 Sprissler, Theodore, 1151 S. Broad
 Stahl, B. F., 1502 Arch
 Staller, Max, 631 Catherine
 Starkey, Frank R., 445 S. 44th
 Steele, J. Dutton, N. E. Cor. 40th and Locust
 Steinbach, L. W., 1309 N. Broad
 Stelwagon, H. W., 223 S. 17th
 Stengel, Alfred, 1811 Spruce
 Stern, Max J., 711 N. Franklin
 Stetson, John B., 1329 Spruce
 Stevens, A. A., 314 S. 16th
 Stewart, A. H., 252 N. 12th
 Stewart, D. D., 1429 Walnut
 Stewart, Francis T., 302 S. 13th
 Stewart, John, 2334 N. 29th

Stewart, Wm. S., 1801 Arch
 Stone, E. R., 1701 Master
 Stone, James F., 1806 Green
 Stout, E. J., 1626 Diamond
 Stout, George C., 1726 Chestnut
 Stout, O., 5th and Glenwood Ave.
 Strawbridge, George, 202 S. 15th
 Strawn, Joseph, 1700 Wallace
 Strecker, H. A., 324 S. 12th
 Strittmatter, I. P., 999 N. 6th
 Strobel, John, 948 N. 5th
 Strouse, Fred M., 2220 N. Broad
 Swan, John M., 3713 Walnut
 Sweet, Wm. M., 1205 Spruce

T

Tait, Thomas W., 318 S. 11th
 Talley, F. W., 1346 Spruce
 Talley, Jas. E., 5602 Lansdowne Ave.
 Tappan, Lucy N., 123 S. 16th
 Target, John D., 1112 Jackson
 Taylor, Charles F., 1520 Chestnut
 Taylor, James Gurney, 6041 Drexel Road, Overbrook
 Taylor, John J., 4105 Walnut
 Taylor, J. M., 1504 Pine
 Taylor, Wm. I., 1825 Pine
 Taylor, William L., 1340 N. 12th
 Teller, Wm. H., 1934 Green
 Thomas, C. H., 3634 Chestnut
 Thomas, F. W., 27 Mt. Airy Ave., Germantown
 Thomson, A. G., 1426 Walnut
 Thomson, William, 1426 Walnut
 Thorington, James, 120 S. 18th
 Thornton, E. Q., 922 Spruce
 Trautman, B., 242 Franklin
 Tucker, Henry, 119 S. 20th
 Tull, M. G., 4629 Baltimore Ave.
 Tunis, Joseph P., Arcade Building, 15th and Market, Room 206
 Turnbull, Chas. S., 1935 Chestnut
 Turner, John B., 1525 Christian
 Tyson, James, 1506 Spruce
 Tyson, T. M., 1506 Spruce

U

Uhle, Alex. A., care German Hospital, Girard and Corinthian Aves.
 Umstead, William, 1624 N. 25th
 Updegrove, Silas, 652 N. 8th

V

Vanderslice, Ed. S., 127 S. 5th
 Van Dervoort, C. A., 3306 N. Broad

Van Gasken, Frances C., 2136 Fitzwater
 Van Harlingen, Arthur, 117 S. 18th
 Vansant, E. L., 1929 Chestnut
 Veasey, C. A., 116 S. 19th

W

Wadsworth, William S., 37th above Chestnut, The Covington
 Walk, James W., 737 Corinthian Ave.
 Walker, Gertrude A., 308 S. 13th
 Walker, James B., 1617 Green
 Walsh, Edward Francis, 111 E. Lehigh Ave.
 Walsh, Joseph, 732 Pine
 Wamsley, James W., 9223 Spruce
 Ward, E. T., 843 S. 3d
 Ward, Nathan G., 1807 Chestnut
 Warder, Chas. B., 1305 N. Broad
 Warder, William H., 1212 N. Broad
 Watson, A. W., 126 S. 18th
 Watson, Edw. W., 131 N. 20th
 Watson, W. N., 4110 Parkside Ave.
 Webb, William H., 556 N. 16th
 Weintraub, Sarah L., 1313 S. 9th
 Welch, William M., 821 N. Broad
 Wells, P. Fraley, 40th and Brown
 Wells, William H., 333 Pine
 Wendell, W. Guthrie, 4435 Baltimore Ave.
 Wentz, B. W., 6602 Woodland Ave.
 Werner, Ellis Bruce, 3805 Baring
 West, John W., 1125 Wallace
 Westcott, T. S., 1833 Spruce
 Wetherill, Henry E., 3734 Walnut
 Wetherill, H. M., 1506 Pine
 Wharton, H. R., 1725 Spruce
 Wheeler, E. B., 1918 N. 8th
 White, Cortland Y., 334 S. 16th
 White, Francis, 1648 Franklin
 White, J. W., 1810 S. Rittenhouse Sq.
 Whiteway, Harold M., 1924 Chestnut
 Whiting, A. D., 1523 Spruce
 Wiggins, E. H., 1801 Cayuga
 Wightman, J. G., 2030 Wallace
 Wiley, Eugene, 330 Reed
 Wiley, H. E., 330 Reed

Wilkins, John W., 1914 Arch
 Willard, De Forest, 1818 Chestnut
 Williams, Gurney, 331 S. 13th
 Williams, Horace, 1717 Pine
 Willetts, Mary, State Hospital, Norristown, Pa.
 Willits, I. Pearson, 33 W. Walnut Lane, Germantown
 Willson, Robert N., 350 S. 15th
 Wilson, H. A., 1611 Spruce
 Wilson, J. C., 1437 Walnut
 Wilson, Samuel M., 1517 Arch
 Wilson, W. Reynolds, 1709 Spruce
 Winter, S. Elizabeth, Indwood, W. Conshohocken, Pa.
 Wise, George G., 420 S. Broad
 Wister, James W., 5277 Main St., Germantown
 Witmer, Albert F., 331 S. 13th
 Wolfe, Samuel, 1701 Diamond
 Wood, A. C., 128 S. 17th
 Wood, H. C., 1925 Chestnut
 Wood, Horatio C., Jr., 129 S. 18th
 Woodbury, Frank, 218 S. 16th
 Woods, D. F., 1501 Spruce
 Woods, Mathew, 1307 S. Broad
 Woods, Richard F., 1501 Spruce
 Woods, Walter, 848 N. 41st
 Woodward, George, 708 North American Building
 Wray, Wm. S., 26 S. 18th

Y

Yard, Jno. B., 327 S. 18th
 Yarrow, Thos. J., 1335 N. Broad
 Yeager, Frank N., 2826 Oxford
 Young, Jas. K., 222 S. 16th

Z

Zeigler, Wm. H., 3028 Frankford Ave.
 Zeigler, S. Lewis, 1700 Walnut
 Zentmayer, William, 1819 Spruce
 Ziegler, W. M. L., 1418 N. 17th
 Zimmerman, M. W., 1522 Locust
 Zuill, William L., 1518 Fairmount Ave.

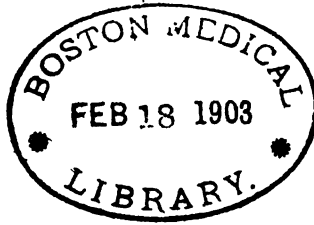
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Eakridge, J. T.,	Colorado Springs, Colorado.
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George A. Bodamer, M. D.,	Agnes B. R. Messner, M. D.,
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A. H. Hulshizer, M. D.,	E. K. Perrine, M. D.,
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Charles Wirgman, M. D.	

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PROCEEDINGS
OF THE
Philadelphia County Medical Society.

Gunshot Wounds of the Knee Joint by the Projectile of Reduced Caliber.

BY LOUIS A. LA GARDE, M. D.

[Read, by invitation, January 22.]

With the use of old armament, wounds of the knee joint constituted 3 per cent. of all wounds observed in military practice and because of its exposed position and the extent of its synovial sac, it gave us 28 per cent. of all joint wounds that came under treatment in war hospitals. Gunshot wounds of this joint were then, as they may be to-day, divided into five classes as follows: (1) Simple perforation of the synovial sac without accompanying bone lesions. (2) Injury to the joint with lodged ball. (3) Injury to the joint exhibiting guttering of the articular ends of the bones. (4) Complete perforation of the bones traversing the joint in different directions. (5) Implication of the joint by fissuring and comminution of the bones entering into its formation.

The treatment employed in the pre-antiseptic era was: (1) Amputation. (2) Conservation. (3) Excision. The first of these, amputation, was the rule and the surgeon who failed to amputate in all gunshot wounds of the knee failed in his duty to his patient. Conservation and excision were at times practiced when patients refused amputation, but even in those cases in which the joint capsule alone was involved, the results of this plan of treatment were so disastrous that it was universally condemned.

When antiseptics came into vogue our first observations of the value of clean wound treatment in military practice as it was then understood, was given to us by Reyher and von Bergmann in 1876-77, during the Russo-Turkish war. Reyher reports eighteen primary aseptic cases of wounds of the knee regardless of the extent of the joint

involvement, treated by antiseptic dressings, of which three died, a mortality of 16.6 per cent. The treatment was strictly conservative without excision or amputation. The cases ending in recovery are said to have movable joints. He employed irrigation in severe cases whilst the simple cases were cleansed externally and dressed with wet carbolic gauze. Von Bergmann employed the same method of treatment with the following results. Out of fifteen cases of gunshot wound of the knee, one of which was complicated by injury to the bony articulation, fourteen recovered, in two of which amputation was required. The fatal case was one in which amputation was practiced. Nothing is said of the amount of motion remaining in those who recovered. The majority of them more than likely got well, as did those of Reyher, with movable joints. The cases so treated by Reyher and von Bergmann occurred before the change in the armament of the nations had taken place. They represent, therefore, the result of injuries by the old soft leaden bullet of forty-five caliber, weighing approximately 480 grains, treated conservatively under antiseptic methods. Grouped together we find that the mortality was for the two sets of cases only 11.1 per cent. Compared to the results of treatment of gunshot injuries by the old arm in the pre-antiseptic era the results of Reyher and von Bergmann were certainly a revelation. In looking over the statistics given us by Otis we find that gunshot wounds of the knee in the Civil War, under all methods of treatment then in vogue, gave a mortality of 53.7 per cent. which, compared to the results of Reyher and von Bergmann, places to the credit of antisepsis a total of 41.6 lives saved in every one hundred men hit in the knee.

In late years changes have come about in the manufacture and composition of rifle bullets to enhance the satisfactory results already alluded to both as to life and limb. The character of gunshot wounds of bones especially is very much influenced by the density of the metals which inflict them.

Longmore, among the old writers, ventured to explain thirty-five years ago what would be the special features of gunshot wounds as soon as it became practicable to use steel bullets. The evolution of the military rifle and the missile it propels to-day have given us a factor which, in a humane sense, stands next in importance to antisepsis.

For military and ballistic reasons which do not concern us in this instance, dating from 1886 to 1893, all the governments changed their armament from rifles of larger caliber and lower velocities propelling leaden bullets easily deformed upon impact with resistant bone, for those of smaller caliber and higher velocities propelling steel-clad

bullets that very seldom deform against the most resistant tissues. Following the example of the other governments, the United States adopted the Krag-Jorgensen rifle as its military hand weapon in 1893. Before doing so, however, the War Department caused to be instituted certain experiments with the bullet of the proposed weapon which I had the pleasure of conducting at Frankford Arsenal in 1892. The experiments consisted in firing into ten cadavers with simulated velocities for all the ranges from one hundred up to 2,000 yards.

The results of these experiments and those of military surgeons in Germany and France engaged in similar work, demonstrated marked differences between the destructive effects of the old and the new arm, and these differences were specially noted after firing into tissues of varying resistance. As a broad principle it may be stated that the amount of destruction was invariably proportional to, first, the velocity; second, the sectional area of the projectile; and third, the resistance which the ball encountered on impact.

In the soft parts like the skin, muscle and lung, tissues offering a minimum amount of resistance, the area of destruction was limited to the channel wound which, as a rule, only equalled the sectional area of the bullet. The more resistant tissues, like the diaphyses of the long bones and those anatomical parts containing a great deal of water, or soft parts enclosed in rigid walls, showed destructive effects which were proportional to the velocity and sectional area of the bullet. For instance, close shots with the two bullets were alike severe in the shafts of the long bones, the intestines loaded with fluid contents, the heart, head, etc. In the mid and remote ranges where we commence to see a marked falling off in the velocity of the two bullets, the amount of destruction accomplished by the reduced caliber bullet was always less than that inflicted by the bullet of the old arm, due doubtless to the smaller frontage of the former.

The epiphyseal ends of the bones compared to the compact substance showed destructive effects in proportion to the sectional area of the projectile. In the close ranges the old leaden bullet showed marked destruction not only because it was primarily greater in sectional area, but because its diameter was usually made greater still by deformation. On the other hand, the smaller caliber bullet showed a marked tendency to make clean-cut perforations in the spongy ends of the bones, due doubtless to its sectional area which was primarily less, and which was never increased by deformation.

The humane features of the new bullet having been so thoroughly established upon the articulation by experimentation, the results of the actual conditions in war were naturally awaited with the greatest interest concerning the results upon the knee.

Makin, in his "Surgical Experiences in South Africa," referring to joint wounds, states that in spite of the fact that the knee was the most frequently wounded among the articulations, such injuries gave less anxiety and attained a more favorable result than is the case in civil practice. Limitation of movement was slight or absent in most cases, and he remembers only one case, a man shot at 300 yards, in which serious ankylosis resulted. He never saw a case of lodged Mauser or Lee-*Metford* ball in a joint, a condition that bears so significantly on prognosis.

The staff of a Civilian War Hospital report that joint wounds gave no serious complications. The wounds healed without difficulty and gave rise to but little synovial effusion. In eight cases of wounds of the knee in which perforation of the patella occurred, a perfectly movable joint resulted, although in some there were complications from wounded vessels and nerves.

Of sixty-two cases of gunshot injury reported to the Surgeon General's Office since July, 1898, from various missiles as follows: thirty caliber Mauser, seventeen; forty-five caliber brass-jacketed Remington, eight; thirty caliber Krag-Jorgensen, two; character of missile not stated, twenty-seven; revolver bullet, caliber not stated, three; small shot, one; shrapnel, three; and shell fragment, one; total, sixty-two. We find that five died, making a mortality of 8 per cent. Two of the deaths resulted after amputation. Of the fifty-seven patients who recovered 45.6 per cent. were restored to duty. If we compare these sixty-two cases with the group of thirty-three cases given us by Reyher and von Bergmann, we find that our mortality was 3 per cent. less than theirs. This is doubtless due in part to the large number of cases by the reduced caliber weapon in our group of sixty-two cases. We may admit for the sake of comparison that gunshot wounds of the knee under our present system of wound treatment in war give us a mortality of 8 to 11 per cent. irrespective of the character of the missile concerned in the production of the injury, and further that 45.6 per cent. of those who recover are fit for duty.

In order to study the full benefit likely to arise from the use of antiseptics and the reduced caliber bullet, a study of the results of wounds from the latter alone should be made. Of nineteen cases occurring in the Santiago campaign, we find that none of the patients died, that fourteen were restored to duty and that five were discharged on surgeon's certificate of disability or otherwise disposed of.

The following table shows at a glance the successive results of gunshot wounds of the knee from the days of the Civil War to the present time:

GUNSHOT WOUNDS OF KNEE JOINT.

Civil War, 1861-65.		33 cases by Reyher and von Bergmann.	
Large caliber,—Antisepsis.		Russo-Turkish War, 1876-77.	
Mortality	53.7%	Large caliber,—Antisepsis.	
Recovery	46.3%	Mortality	11.1%
Total	100.0%	Recovery	88.9%
Fit for duty	00.0%	Total	100.0%
Unfit for duty	100.0%		
62 cases.		19 cases.	
Report Surgeon General's Office since 1898.		Santiago Campaign, 1898.	
Various calibers,—Antisepsis.		Reduced caliber,—Antisepsis.	
Mortality	8.0%	Mortality	00.0%
Recovery	92.0%	Recovery	100.0%
Total	100.0%	Total	100.0%
Fit for duty	45.6%	Fit for duty	73.6%
Unfit for duty	54.4%	Unfit for duty	26.4%
Total	100.0%	Total	100.0%

To recapitulate, we find (1) That the mortality of gunshot injury to the knee joint in the Civil War was 53.7 per cent., and as amputation was universally done all those who recovered escaped with the loss of a limb, unfit for duty. (2) That thirty-two cases of gunshot wound of the knee produced by the larger caliber lead bullet in campaign, reported by Reyher and von Bergmann, treated antiseptically, gave a mortality of 11.1 per cent. (3) That sixty-two cases produced by a variety of missiles reported by the Surgeon General since 1898, similarly treated, gave a mortality of 8 per cent. and that 45.6 per cent. of those who recovered were restored to duty. (4) That of nineteen cases in the Santiago campaign by the reduced caliber, the mortality was nil and that 73.6 per cent. of the wounded recovered fit for duty. It is thus seen that the humane features of the reduced caliber bullet have operated not only in diminishing the mortality in gunshot injuries of the knee from about 8 or 11 per cent. to nil, but that they have increased restorations to duty 28 per cent. as shown by comparing the last two tables.

The foregoing figures relating to the humane features of the reduced caliber bullet establish fully the predictions of von Coler, who said at

the conclusion of his experiments with the German Mauser, that if it is found that wounds by the small bore are aseptic, joint wounds will be the most favorable of all bone injuries to treat.

DISCUSSION.

DR. WILLIAM L. RODMAN said that he had been interested in hearing the paper of Dr. La Garde, who is an authority on gunshot wounds in general and on gunshot wounds of the joints in particular. The chart illustrating the evolution that had taken place in gunshot wounds of the knee from the time of the Civil War to the battle of Santiago was of great interest to Dr. Rodman. Statistics gathered during the Crimean and Franco-Prussian wars were of historical rather than of practical value. The results at the present time, of course, would differ since the treatment is entirely different. Then amputation was the rule; at the present time, in military practice, noninterference should be the rule rather than the exception. Although excellent results have been secured in military practice Dr. Rodman did not believe that as good results would be so uniformly secured in private practice, in which an entirely different class of injuries was dealt with. Such injuries were made at close range and usually with a revolver, on which account the destruction that is wrought primarily and the consequent danger of secondary infection would be much greater than in military practice. For this reason Dr. Rodman believed that a different plan of treatment would frequently, but not always, be necessary. In 3 gunshot wounds of the knee in Dr. Rodman's practice all were treated without amputation; all made reasonably good recoveries; 2 very good indeed. All were treated before the days of the X-rays and it was impossible to tell just exactly the extent of the injury wrought at the time. Dr. Rodman believes that the greatest danger in pistol-shot wounds is from infection produced by clothing carried into the wound. For that reason he considered that it frequently would be better treatment to open the joint, irrigate freely and remove the ball if it had lodged. The pistol ball frequently lodges, while the modern rifle ball practically never does. He believed that amputation at the present time should not be considered in civil practice much more than in military. He would hesitate to advise amputation in pistol-shot wounds of the knee joint, unless there was extensive injury to the artery, vein or large nerves. Dr. Rodman had in one case opened the joint freely, performed partial resection and extracted the bullet; the result was perfect. A partial resection would, Dr. Rodman thought, often have to be done when the ball had produced extensive comminution of the femur, tibia or both and was possibly lying loose in the joint. When a pistol ball had penetrated a joint, or even perforated it, and had not produced any extensive injury to the bone, immobilization without irrigation, he thought, should be the practice, because such cases are usually not infected at the time of the injury, but may be by injudicious interference. He referred to Nussbaum's statement that in any compound fracture the fate of the injured was in the hands of the first surgeon who attended him. He believed that during all wars a majority of the cases in which amputation or resection had been made necessary was on

account of the septic finger or septic instruments of the surgeon. Dr. Rodman believed that the profession had not made as great progress in the treatment of gunshot wounds of the joints in civil practice as had been made in military practice. There was, however, in civil practice a decided advance, and amputations and resections for gunshot wounds of the knee should be seldom heard of at present.

DR. G. G. DAVIS stated that since the character of gunshot wounds had changed because of the difference in caliber and velocity of the bullet it necessarily followed that the treatment should be different. One of the first duties of the surgeon was to ascertain by what kind of missile the wound had been produced. In civil practice wounds produced by the bullet of small caliber and high velocity were of rare occurrence. Such injuries at present would only be produced by rifles. In civil practice, therefore, the character of the wounds was but little changed, black powder cartridges being still commonly used. In military practice the case is different. It was in the army, Dr. Davis stated, that the destructive character of the small caliber, high velocity rifle was demonstrated, and as a consequence these small caliber rifles are gradually being introduced all over the country for hunting purposes; hence wounds occurring from them will hereafter be seen also in civil practice and it behooves the surgeon therefore to acquaint himself with their character. Dr. Davis explained the 2 actions of a bullet in tearing through the tissues as an onward or perforative, and a lateral or explosive action. In warfare any attempt to increase the explosive action of the bullet had been ruled out. In some cases the bullet had been found so deficient in stopping power that means had been devised to increase its lateral effect, and the nickel mantle was discontinued at about $\frac{2}{3}$ the length of the missile, leaving the leaden point exposed. This was named the dum dum bullet. A ball known as the Jeffrey bullet was sometimes used in the Boer war; in it there were 4 slits that allowed the bullet to flatten, causing considerable lateral action and great comminution. If a bullet passes through muscle or soft tissues lateral action is not great. Striking of the bullet against compact bone will cause a Jeffrey or dum dum bullet to expand sufficiently to mushroom and produce very destructive lateral action. For this reason perforations of the compact tissue of long bones of the body are not found as frequently as perforations of the cancellous ends of the bone and of the small bones like the patella, as evidenced in our wars and that in South Africa. Another reason for the innocuousness of the small caliber, jacketed bullet was because clothing was not taken into the wound with it. This was entirely different from the result seen in private practice from revolver bullets which, though as small as the small caliber rifle bullets, being softer and moving with much lower velocity, often carried the clothing into the tissues. One of the first duties of the surgeon was to ascertain whether or not any part of the clothing had been taken into the wound, thus infecting it. Contrary to what had been predicted, hemorrhage from the high velocity and full-jacketed bullets, it was stated, was not extensive compared with the old bullet. In fact, the bullet had been found to wander almost ad libitum through the tissues, pushing aside the arteries and veins, and to a great

extent the nerves and not producing fatal bleeding. A peculiarity pointed out was the effect of the bullet upon the soft organs. Experiments made by shooting into cans of water demonstrated that the force was transmitted in all directions and it was thought this would also be seen in wounds. Shooting into dead animals gave tremendous shattering of the bones and tearing of the tissues and it was thought this would be shown likewise on the living body. It had been shown, however, that the character of the wound made on the living, and on the dead, animal was to a considerable extent different. The living elasticity of the tissues prevented that destructive lateral action frequently seen in the dead body. It had been demonstrated by the wounds received in the recent wars that the heart, the liver, the kidney and other soft organs had not shown the marked result of the explosive action that had been expected. Admitting that the results of treatment were better now than previously, Dr. Davis said the question arose as to the cause of these good results, whether due to the character of the bullet or to the superior skill and knowledge in the treatment of wounds. He had been interested in a recent article by Watson Cheyne in the *British Medical Journal*, in which he said that modern surgery had but little to do with the results; that they were due to the character of the bullet and to the climate. First-aid dressing, Cheyne said, was often but little more than a clean rag and not often clean at that. That the results have partly been due to the character of the bullet, Dr. Davis stated, was indisputable. When, however, it was said that modern surgery did not have anything to do with the result, Dr. Davis thought the profession would not agree with Mr. Cheyne. Other writers were almost unanimous in attributing to the treatment a part at least of the good results, and the value of the first-aid package is certified to by almost all surgeons writing on the subject, among whom, of our own men, were Senn, Robinson and Borden. Sir William MacCormac said that, notwithstanding the climate of Cuba, the results were good. Bowlby and Wallace, working in South Africa, praised the use of this first-aid package very much, and Major La Garde has shown the good effects of modern treatment in the Russo-Turkish war in which large caliber weapons were used. In treatment an established principle was that a gunshot wound need never primarily be probed; that a wound need never be disturbed, except to stop bleeding, until the patient has been brought to the base hospital. Any previous interference, Dr. Davis said, was unjustifiable. The mackintosh which was included in the first-aid packages when first issued, Dr. Davis said, had been found undesirable since it retained the moisture of the wound and thereby promoted the growth of germs.

DR. MORDECAI PRICE stated that a few years ago, when the small caliber rifle was introduced into the army, he had heard much of its frightful effects. He had not been able to understand from the character of the bullet or from its velocity how such destruction could be possible. He was glad to note from the paper of the evening that these ideas existed rather in the brain of the writers than in fact. Dr. Price had been using the rifle since he was a boy and he believed the character of the wound was determined by the nearness of the object, the character of the bullet and the exactness

of the aim. Reference was made to the "upset bullet," so constructed that it would light on its side and cause great tearing.

DR. ERNEST LAPLACE said that he could conceive of nothing in the realm of gunshot wounds that could be more in keeping with the progress of surgery from infection to asepsis, than the change from the soft lead bullet to the hard, small, steel-jacketed bullet. The wound produced to-day is as thoroughly aseptic as it is possible for a gunshot wound to be. Given such ideal conditions in gunshot wounds the surgeon should not be satisfied with anything less than a perfect result. Patients should not be allowed simply to get well with limbs that are useful in a general way. What has been said about the first-aid package should be given much attention. Nothing can be more important than the immediate closure of the wound, and nothing can be better adapted to this than the first-aid package as originally devised. Septic symptoms may come from 2 sources, from without and from within. The most innocent looking wound may become as bad as if it had been most extensive if the patient's blood and system are not what they should be. This is especially true in the case of the syphilitic diathesis.

DR. GUY HINSDALE said that he had assisted Captain La Garde ten years ago in the investigations ordered by the Secretary of War which had resulted in the adoption of the small caliber arm.

MAJOR LA GARDE, in closing the discussion, said that he thought the point made by Dr. Rodman of the difference in treatment in civil and military practice was well taken. So far as the knee joint was concerned, it might be said that in military and civil practice the surgeons came to a parting of the ways. He believed that the civil surgeon is more often tempted and more often justified in cutting into the joint to investigate the destructive effects, and that whenever he does go in he makes no mistake. Major La Garde said that he believed that the Boers had often been wrongly accused of using the dum dum bullets. He was convinced that he could produce all the explosive effects of a dum dum bullet, with the high velocity, jacketed bullet at close range, provided there was resistance. Regarding the stopping power of the little bullet Major La Garde had questioned hundreds of soldiers in Cuba and could learn nothing more definite than that when a man was hit it seemed to be the rule to fall back. The soft-nosed bullet could be produced by any one by filing the steel part of the nose. Regarding the ruling out in war of the explosive bullet referred to by Dr. Davis, Major La Garde said that England had, in the St. Petersburg convention of 1868, reserved the right to use any kind of explosive missile on account of a possible struggle for her existence. The results in wounds of bloodvessels referred to by Dr. Davis, had also been surprising. Cases had been reported from South Africa of injuries of the femoral artery in which the bleeding had suddenly ceased. Though the men were provided with tourniquets, Major La Garde thought the best use to make of them was to throw them away, for the danger was to apply them too often. In some cases gangrene had almost occurred from strangulation by applying the constriction where it was not indicated. Much was to be said regarding the value of the first-aid dressing. He himself could only say in favor of it that a surgically clean dressing was lying in contact with the wound which would act as a barrier to a further introduction of septic matter.

Exhibition of a Case of Multiple Exostosis.**By J. P. MANN, M. D.**

[Presented January 22.]

The patient, who is of English birth and 31 years of age, presented himself for treatment at the Orthopedic Department of the Medico-Chirurgical Hospital. His parents and grandparents were healthy and lived to ages varying from 68 to 102 years. The patient himself has never been ill until 16 weeks ago when he had typhoid fever and was in the hospital for 12 weeks.

When he was three years old the patient's parents first noticed symmetrical enlargements in the regions of his joints. On the left side these were more marked than on the right. They continued to grow until the patient was 23 years of age. There is no specific history and no history of traumatism.

Instances of single exostosis are not rare, but multiple exostosis is of infrequent occurrence.

The American Text-Book of Surgery gives an illustration of a skeleton in which the growths are more pronounced and more numerous than those in the patient here presented. My experience of having seen but one person with multiple exostosis is also the experience of my colleagues, Drs. Rodman and Laplace.

Many writers claim that the condition is of syphilitic origin. Others, who deny this, speak of it as spontaneous exostosis, which in my opinion, is only a cloak for ignorance of its cause. Personally, I think that syphilis will not explain such a case as this one.

President's Address.**By GEO. ERETY SHOEMAKER, M. D.**

[Read February 12.]

The annual address of the president of an organization such as this has of late years usually been of a scientific character, and very properly so. This evening, however, I have ventured to depart from this excellent custom because the time appears to be an important one in the history of the society, and there are certain matters which should receive wide consideration. The mere fact that so radical a departure as subdividing the membership into branches has been made during the past year is sufficient reason for reference to some matters of general policy on an occasion such as this. An experience of five years as director or other officer leads your speaker to certain conclusions, and a few remarks in regard to what are considered to be our interests may not be out of place. It is sometimes lamented

that the attendance is unsatisfactory, but this has not changed greatly in recent years. The great multiplication of small special societies is an outgrowth of the advance of medicine, and is necessary to the proper development of specialties. Men interested in definite lines of practice gather in small groups, whose members have similar interests, and where technical papers are appreciated and discussed. These meetings use up the time which many active and progressive men feel that they can afford to give regularly to medical society work. To that extent a large number of valuable members are withdrawn from active participation in the meetings of this society though they remain on its membership roll.

There still exists, however, a need for a large society where neither social, local nor academic standards prevail and where all may meet, not as surgeons, oculists or gynecologists, but as physicians, interested in the broad subjects of the medical life of the day, and in the practical problems of sanitary science. More than this, it may be said that no specialist, however narrow the limitations of his work, and least of all the young specialist of recent type who has had no general medical or surgical training outside of his hospital interne service; no specialist, let me repeat, can afford to cut himself off from contact with the broader lines of medical thought lest he weaken his judgment, warp his standards and impair his value to his patients. It is, then, one of the high purposes for which such a society as the County Medical exists, to furnish a place where men of all types can meet on common ground, and mutually profit by contact.

It is peculiarly the duty, and it has largely been the practice, of the Boards of Directors who control the literary material presented on our programs to develop topics of general interest, and by a wise arrangement of discussion to secure an expression in our proceedings of the best opinion of the day on matters about which no one can afford to be ignorant.

It is with such purpose in view that certain memorable meetings have been planned in recent years and that such subjects as the following have been considered: Medicolegal relations of induced abortion which has been accidentally encountered; diphtheria, its diagnosis with and without bacteriology, various views as to antitoxin and other forms of treatment; lantern demonstration of kidney lesions, etc.; the registration of tuberculosis; the various living questions as to vaccination, smallpox, syphilis and gonorrhea; the management of placenta previa; of posterior presentations and other obstetrical complications which all encounter. Meetings so planned, if well attended, exert a wide and potent influence for good.

The mere fact that membership here carries with it membership

in the State Society and secures eligibility for the national organization is of vast importance in unifying the medical profession and making it a power. From contact with a great cosmopolitan body such as this, there comes an influence upon character not to be despised, fostering charitable consideration for the opinions of others, and eliminating prejudices against those one has never met.

There is in the minds of some a tendency to emphasize the importance of locality of residence, and this has been recently dwelt upon by those who have advocated the branch societies. It may be argued in reply that the successful practitioner of the central city needs the contact with his hard-worked brother in the suburbs, and *vice versa*. The man who lives far north or west needs to brush against his brother of the far south or east and neither can afford to shut himself up to an acquaintance in his own neighborhood.

The recent movement to found branch societies has originated in the northern and southern sections of the city, and the chief argument for them has been founded on the distance from the city's center, though the new meeting places are within fifteen minutes' ride of the City Hall. Time will tell what their influence may be on the parent society. It may be safely predicated that they will fall short of conspicuous usefulness if they tend to foster a sectional spirit and lead men to ignore the fact that they belong to the great body of the medical profession of this city, and that they owe a public-spirited duty to make it a strong, coherent and representative organization. If new members attending branches fail also to attend some business and stated meetings of the central society, they miss the great reflex advantage of belonging to a large organization with varied elements, and they reap no more moral benefit than from purely neighborhood societies such as have existed for many years.

On the other hand, it is hoped that new members may be obtained through the branches, and so far about forty have been so obtained. These, it is hoped, will be brought into closer touch with the general profession and, participating in the advantages of membership in city, State and national organizations, they may give of their strength and influence to further the interests of the whole medical body.

A new edition of the by-laws, many years out of print, will, it is hoped, soon be in the hands of the members. This will lead to a better understanding of some points of organization, and will also furnish a copy of the Code of Ethics.

Considerable misapprehension exists as to the amount of money available for the publication of papers read before the branch meetings. Hitherto no money has been available to publish papers not read in the central society; though, of course, all papers of merit, wherever

read, appeared in medical journals by private arrangement. It should be understood that \$1.25 out of the four dollars due from each member annually, must each year be paid into the treasury of the State Society. This takes 31 per cent. of the income from dues, and over 40 per cent. more is now expended for publication of the transactions of the main society, which leaves barely enough, with economy, to pay salaries, rent of hall and other necessary expenses, with a membership of about 790. The publication of papers of the central society cost in 1901 \$1,531.61. The printing of the papers read in both branches would cost at least \$1,400.00 a year, which would raise the dues of all members of the organization 30 or 40 per cent., that is, to between five and six dollars. The publication of material read at sections has never been undertaken by the College of Physicians, where each section provides for itself by dues, usually as great as those of the County Society, and these are paid in addition to the large dues of the College.

The past year has been a prosperous one. The quality of material obtainable for the programs has been highly gratifying. The method of prompt publication and distribution each month of all papers and discussions has secured more attention for them than was accorded when a year's transactions was received at once. Too much material to be printed has taxed the resources of the society. It is earnestly recommended that not only shall papers be limited to twenty minutes, but that not more than 4,000 words be published from any one paper. The main facts about the administration of so large a body are difficult to obtain if members do not attend business meetings. It is for this reason that reference is made to some of them here.

The retiring president appreciates the cordial support which has been rendered to him during the past year and would wish for his successor a continuation of the harmony that has marked the progress of our organization.

Specimen Showing Bullet Wound of Heart.

By W. S. WADSWORTH, M. D.

[Exhibited April 9.]

The wound was inflicted about ten days before the patient's death. The man had been shot in the left side in such a way that the bullet passed below the sixth intercostal space, cutting the edge of the sixth costal cartilage for about a third of an inch, passing inward, downward and to the left. It passed twice through the pericardium, leaving two holes about an inch apart, and through the very tip of the heart. The exit was through the ninth interspace.

There was a pyramidal area of slough with the wound as a base and the apex of the pyramid touching the endocardium. In the pericardium there was some well organized clot and also considerable recent clot and blood. There was apparently some effort at repair on the part of the ventricle and pericardium. The slough in the heart wall, by weakening, allowed the secondary and fatal hemorrhage from the heart.

In the area of injury there was a softened material, showing that when the bullet made a nick in the heart it had caused distinct bruising. A bullet not only carries septic material in with it, but also actually bruises the surrounding tissues. The appearance of bruising was evident in this case before the heart had been cut into. Any opening into the chest would probably have resulted in the prompt death of the patient from bleeding. Considerable pressure was evident inside the thorax by the fact that the lung was crowded up to the very apex of the chest. No indication of injury to the heart was present before death.

DISCUSSION.

* DR. JOHN B. ROBERTS said that it seemed a pity that the condition was not known before death in order that surgical treatment could have been undertaken. He could readily see how the condition was not diagnosed because there was no external bleeding and the heart was injured so slightly. Looking at the specimen, it seems to be an easy thing to stitch up the wound. The hemorrhage, he understood, came from the interior of the heart and not from a branch of one of the coronary arteries.

SYMPOSIUM ON CHOLECYSTITIS.

[Read February 26.]

The Pathology of Cholecystitis.

BY JOSEPH MCFARLAND, M. D.

The gall bladder, a small, pyriform sac seated in its own fissure on the inferior surface of the liver, receiving and discharging bile through its duct which communicates with the hepatic duct, appears to be an organ of inconsiderable value. Thus its congenital absence is not incompatible with health, as it is naturally absent in the elephant, rhinoceros, camel, goat, deer, several species of fish, some birds and some of the rodents. It has been found congenitally absent in man in at least fifteen reported cases.

Of these cases in which the gall bladder was wanting, six were children, and eight adults, while the age of one case is not given. In the analysis of the cases made by Eshner, he was led to believe that the majority of them depended upon the obliteration of a previously existing organ rather than upon the congenital absence of the organ.

Whether the gall bladder was congenitally deficient or became subsequently occluded does not matter, as either condition shows us that the persistence of the gall bladder is not essential to life and health. This is further shown by the fact that the gall bladder may be surgically removed without subsequent disadvantage to the patient.

The unimportant function of the organ, its peculiar isolated position, its unimportant contents and the mode of the reception and disposal of its contents combine to make the diseases of the viscus of inconsiderable importance, so long as they remain localized, and to lessen the possibility of the occurrence of any characteristic symptomatology by which they can be clinically recognized. It is, therefore, chiefly, if not only, when the disease of the gall bladder extends to other structures that much importance need be attached to it.

There are three principal diseases of the gall bladder: *inflammation*, *calculus* and *carcinoma*, these three being intimately related to one another and probably not infrequently succeeding one another.

Inflammation of the gall bladder, or *cholecystitis*, depends upon infection. As the normal bile is sterile, the advent of micro-organisms into the gall bladder is to be looked upon as pathological. Two avenues of entrance present themselves; first the blood by which infection of the wall of the gall bladder first occurs, the entrance of the micro-organisms into its contents succeeding; second, the ducts by which the micro-organisms may find their way from the intestine into the gall bladder. Infection of the viscus probably occurs through both avenues, though probably more frequently by the circulation than by the bile duct. Whatever the avenue of the infection, the subsequent changes will depend upon the virulence and the peculiarities of the invading micro-organisms. If these be mild in operation, slight catarrh of the mucous membrane may be the only pathological change; if more active, suppuration with resulting admixture of pus and bile in the gall bladder may take place, or the wall of the gall bladder may be covered with pseudomembrane and show larger or smaller ulcerations. In very severe cases phlegmonous inflammation may undermine the mucous membrane, interfere with the blood supply of the organ and lead to gangrene. In nearly all cases of cholecystitis the extension of the inflammatory process into the cystic duct leads to its early occlusion, so that bile is then prevented from entering or leaving the gall bladder. Such an occlusion may be temporary or permanent, the temporary obstruction being relieved by a return of the mucous membrane to its normal condition, thus permitting the purulent bile to escape. Under such circumstances the bile of the hepatic ducts may become infected and a cholangitis make its appearance. When the obstruction of the cystic duct is permanent, subsequent changes will

vary according to local conditions. The mild superficial form of inflammation leading to a progressive accumulation of a watery mucus by which the gall bladder becomes enormously distended with a clear watery fluid. This is described as *hydrops vesicæ felleæ*. When inflammation is more active and suppurative the gall bladder may be distended with pus, thus forming an empyema of the gall bladder. This fluid collection distends the gall bladder until it forms a cylindrical mass descending almost to the pelvis. Rupture of the gall bladder may then take place, the effect varying according to the infectiousness of the contents. In cases in which the inflammatory process is restricted more distinctly to the deeper tissues, and in cases in which the inflammatory process is extremely chronic, fibroid thickening and contraction take place, reducing the viscus to a small, irregular, thick, pouched tube in which a small quantity of tenacious, dark-colored, inspissated bile is found. It may be by these means that the condition already pointed out as absence of the gall bladder, has arisen. In less mild inflammatory conditions, such as result from infection from the typhoid fever and colon bacilli, a mild catarrh of the gall bladder accompanies the growth of the micro-organisms in its contents. This causes the bile to mix with an unusual quantity of mucus by which its viscosity becomes increased. The micro-organisms occur in clumps or masses in this viscid material and form the nidus upon which bile salts, bilirubin-calcium and bilivirdin-calcium, are deposited, thus beginning gall stone formation. We thus find gall stones the result of cholecystitis depending upon infection of the gall bladder by micro-organisms of mild virulence. The formation of some gall stones thus depends upon precipitation of the bile salts upon a more or less reticulated mass of bacteria. Their structure is originally soft, possibly pulpy, but as more and more salts are deposited they become firmer and ultimately hard by the infiltration of their entire substance with cholesterol formed by the epithelial lining of the gall bladder. All gradations of gall stone formation can easily be observed in the morbid anatomy room.

Sometimes gall bladders are found filled with inspissated bile, rich in bacteria, sometimes filled with bile containing a pulpy mass, probably a precipitate of the bile salts about this bacteria mass; sometimes the entire contents of the organ will be pasty, mushy, gritty or gravelly; sometimes a single stone and sometimes a large number of stones will be present.

Acute cholelithiasis, while thus a result of cholecystitis, later becomes the cause of chronic cholecystitis. The stones contained within the gall bladder irritate it in proportion to their number, size

and other physical qualities. A single large calculus with a smooth surface, probably occasions very little disturbance, while numerous small calculi, by occasionally passing into the duct, cause periodical attacks of obstruction, with painful swelling of the gall bladder from retention of its contents. Calculi small enough to enter the duct, but not small enough to pass through it, known as "ball valve" calculi, are also extremely troublesome, by periodically plugging the neck of the bladder and obstructing its ducts. The pressure of the gall stones upon the mucous membrane of the gall bladder is succeeded by ulcerations and by the entrance of bacteria into the tissues of its wall, thus predisposing to phlegmonous inflammation and gangrene. The mural lesions may be so destructive that rupture of the gall bladder occurs and the stones escape into the abdominal cavity, the duodenum, the stomach or externally. Very large gall stones escape into the intestines by ulcerations of the wall of the gall bladder, a large stone having been known to occasion intestinal obstruction. In very rare cases, gall stones have been vomited after ulcerating their way into the stomach, and in still more rare cases they have been expectorated after having worked their way through the diaphragm and pleura into the air passages.

The severe forms of cholecystitis, such as are accompanied by pericholecystitis and gangrene of the gall bladder, may occasion metastatic lesions of remote organs of the body. If bacteria are absorbed and enter the blood, or if the products of bacterial metabolism are absorbed from such lesions, hectic fever and other signs of systemic intoxication may appear. Spontaneous recovery from cholecystitis is usually succeeded by marked induration and contraction of the entire viscus; the organ then appearing small, pale, oblique and not infrequently showing numerous diverticula in which small calculi are not infrequently contained.

Notwithstanding the clinical evidence that cholecystitis is more frequent in women than in men, in the aged than in the young, in the sedentary than in the active, in the rich than in the poor, in the over-fed than in the under-fed, etc., there seems to be very little real relationship between these so-called predisposing causes and cholelithiasis.

The Etiology and Diagnosis of Cholecystitis.

By JOSEPH SAILER, M. D.

The etiology of cholecystitis involves the study of the formation of the chief predisposing cause—that is, biliary calculi. Of course, the term implies an inflammatory condition of the gall bladder, and,

so far as we know, this inflammatory condition can be caused only by the presence in the gall bladder of micro-organisms that infect the mucous membrane; but there is abundant evidence to show that the mere presence of micro-organisms in the bile—a condition that, contrary to older belief, is by no means uncommon—does not by itself imply cholecystitis. Of course, under ordinary conditions the gall bladder, although communicating directly with the infected intestinal tract, does not contain bacteria, and the bile itself is sterile—not because it contains any bactericidal substance, but because it has very little nutritive material, and its continual outflow prevents the ascent of micro-organisms along the duct. Whenever any interruption in the flow of bile occurs, or when a systemic disturbance occurs associated with bacteriemia, we should expect, on theoretical grounds, to find micro-organisms in the bile, especially in the more or less stagnant portion contained in the gall bladder. Interruption in the outflow of bile can probably be produced in two ways: either as a result of catarrhal inflammation of the mucous membrane of the bile duct, or as a result of some material in the gall bladder which may permanently or periodically block the common or cystic ducts.

It is probable that catarrhal inflammation of the common duct extending to the cystic and hepatic ducts, and perhaps even to the gall bladder itself, is often associated with inflammation of the duodenal portion of the small intestine. There is not sufficient pathological evidence upon this point, but the clinical evidence, such as slight icteroid discoloration of the skin and urine or the absence of pigment from the stools, with pain over the liver, points strongly in this direction. The latter condition is produced by gall stones, clots or mucus plugs, the last being not uncommon in severe catarrhal inflammatory conditions of the gall bladder (Mayo Robson), either chronic or acute, and serving to form a vicious cycle. That is to say, the catarrhal condition due to the presence of micro-organisms gives rise to the mucus plugs, which in turn interfere with the outflow of bile, and therefore have a tendency to prevent spontaneous cure of the infection and actually increase the diseased condition by preventing the elimination of micro-organisms from the gall bladder and favoring renewed infection from the duodenum. Clots have been found in the gall bladder by Claude, after the experimental injection of animals with bacterial toxins, and he suggests that they may form the nuclei of gall stones.

It is questionable whether the bile ever escapes infection in cases of bacteriemia. We have considerable evidence to prove that it is almost invariably infected during typhoid fever, and there is evidence which shows that it is sometimes infected in pneumonia,

although the bacteriology of the gall bladder in this condition has not yet been as systematically studied as it has been in the former disease. Of course, as we have already said, the presence of micro-organisms does not necessarily imply the existence of infection of the gall bladder. Typhoid fever is favorable to the production of cholecystitis, because there is not only inflammation of the intestinal tract but also bacteriemia. It is perhaps unnecessary to mention that this relation was first pointed out by the French authors Gilbert and Girode, and proven by the systematic investigations of Chiari. The relation between typhoid fever and cholecystitis is usually supposed to be indirect—that is to say, as a result of the infection of the gall bladder, gall stones are produced, and these irritate the mucous membrane and may or may not cause inflammation of it. If inflammatory change does occur, it is sometimes associated with the presence of the typhoid bacillus, which has remained latent in the bile, or sometimes with the presence of other micro-organisms the entrance of which has been facilitated by the existence of the gall stones.

It must be admitted that until the publication, in the year 1893, of the results of Chiari's work, the discovery of gall stones and of cholecystitis following typhoid fever was looked upon as an interesting curiosity. Chiari's attention was called to this question by an autopsy upon a boy of twelve years who died in the fifth week of an attack of typhoid fever, as a result of necrotic infection of the gall bladder with secondary circumscribed purulent peritonitis. He found typhoid bacilli in pure cultures in the bile, and was able to stain them in the walls of the gall bladder. He, therefore, examined the gall bladders of twenty-two cases of typhoid fever, and found the typhoid bacillus in nineteen. In fifteen cases it was alone, and in four it was associated with other micro-organisms. Microscopical examination of the walls of the bladder in the nineteen positive cases showed inflammatory changes in thirteen, which consisted of round cell infiltration of the mucosa, congestion of the bloodvessels, and edema of the tissues. He also found the bacilli in the large gall ducts.

In the post mortem examinations that I have performed upon cases of typhoid fever, I have, wherever possible, made cultures from the bile. In six cases the results were positive, and in three of them the micro-organisms were found in pure cultures. It is an interesting fact that the typhoid bacilli are usually found in clumps as if—according to Richardson—a gigantic Widal reaction had occurred. This led the latter author to suspect that perhaps these clumps of bacilli formed the foci about which the cholesterin that constitute the gall stones was deposited. He was able to produce gall stones in two rabbits into whose gall bladders he had injected pure cultures of

typhoid bacilli. This experiment had previously been attempted with negative results by Gilbert and Dominici. Cushing has also obtained positive results. Considerable evidence, however, had been collected before this experiment was performed, which tended to show that typhoid fever had some direct relation to gall stones. Miliau, for example, examined some gall stones removed from the gall bladder of a woman on the sixteenth day of an attack of typhoid fever, and found typhoid bacilli in their centers. Imhofer mentions the case of a woman, forty years of age, who, six weeks after convalescing from an attack of typhoid fever, developed symptoms of peritonitis. An operation was performed, and the gall bladder found greatly distended; its surface was covered with a fibrinous deposit, and its cavity contained a thick mucopurulent material and a hazelnut-sized gall stone. Droba mentions a still more remarkable case in a woman fifty-three years of age, who had had typhoid fever seventeen years before coming under observation, and since then had suffered with repeated attacks of colic. An operation was performed and numerous stones removed from the gall bladder. Typhoid bacilli were found, not only in the bile, but also in the interior of the stones. This case is remarkable on account of the long persistence of the bacilli in the gall bladder.

That the bile from an inflamed gall bladder is an excellent culture medium is shown by an experiment I made some years ago at St. Joseph's Hospital. A sterile test-tube was filled with bile taken from the distended gall bladder of a patient who had died of typhoid fever. It was kept for a period of more than three months, and from time to time cultures were made from it which showed nothing but typhoid bacilli, and these were constantly used in the laboratory of the hospital for the purpose of making the Widal reaction.

The evidence, however, is not as conclusive as it seems. In fact, there is some reason to suppose that the opinion that has begun to gain credence, that gall stones are due only to typhoid fever, is not tenable. Even some of the positive evidence can be interpreted in the opposite manner. It seems remarkable that Miliau's patient should have developed well formed gall stones in the course of sixteen days; and Chauffard, who has made a careful study of the subject, reaches the conclusion that probably in many cases the gall stones are preformed and are penetrated by the typhoid bacilli when infection of the bile takes place. From the loose texture and friability of the gall stones there is no reason to suppose that this could not occur, and Gilbert, Fournier, Hanot and Letienne have shown experimentally that young gall stones can be so penetrated. Even in old and hard stones Chauffard has found the colon bacillus. In

statistics of 171 cases of typhoid fever he was able to find only eighteen that had had attacks of biliary colic after the disease, and five that had had attacks before the disease, and therefore presumably before typhoid infection had existed. In only one of the eighteen cases did the symptoms come on immediately after the attack, and in the others the shortest interval was four years. Moreover, in eighty-six cases of cholelithiasis and cholecystitis only eighteen gave a history of typhoid fever, and in eighty-six other hospital cases of about the same age, fifteen had had that disease. Chauffard also calls attention to the rarity with which freshly formed gall stones are found after an attack of typhoid fever. Chauffard's investigations appear to have been carefully made, and they seem to prove that the mere discovery of typhoid bacilli in the interior of a gall stone after an attack of typhoid fever is not sufficient proof that it bears any causal relation to the disease. Moreover, it seems to show that gall stones are formed comparatively rarely after typhoid fever, and that they occur almost as frequently in patients who have never had that disease. The typhoid bacillus is capable of producing inflammatory conditions without the presence of gall stones, and Wunschheim claims that this is not infrequent, pus forming in the gall bladder, and sometimes giving rise to a pericholecystitis with fibrinous deposits or adhesions, or this process may occur independently.

Among the other micro-organisms that have been found associated with suppurative angiocholitis and cholecystitis or with gall stones are the colon bacillus found by Bignami, Gilbert and Dominici, and especially by Mignot, who has produced biliary calculi by introducing cultures of colon bacteria whose virulence had been reduced into the gall bladder; the cholesterin accumulated about the fragments of necrotic tissue; and the streptococcus which was found by Dupré in the case of a woman who died with symptoms of chronic icterus and carcinoma of the liver. At the autopsy on the latter case the gall ducts were found to be thickened and to contain numerous stones, and the walls were covered with a purulent exudate in which numerous streptococci were found. Dupré also calls attention to the cases of Claisse and Malvoz, in which streptococci appear to have been the cause of combined cholelithiasis and cholecystitis. Other bacteria have been found by Hugounencq and Doyen, and a series of experimental inoculations have been made by Gilbert and Dominici with streptococci, staphylococci, pneumococci, typhoid bacilli, colon bacilli and cholera vibrios, all with negative results.

The route by which the micro-organisms reach the bile cannot be definitely determined in the majority of cases. The fact that in

typhoid fever we nearly always have a mixed infection of the duodenum and frequently find a pure infection of the bile is evidence, in itself, that the usual route is along the bloodvessels, for it seems certain that if infection occurred along the common duct it would be mixed. Claude has reported two cases in which evidence at autopsy in the form of an infectious arteritis seemed to indicate that the infection was hematogenic. Assuming the infection of the gall duct, the question arises whether the existence of micro-organisms in the bile or the existence of gall stones is the responsible factor. Janowski suggests that the continual mechanical irritation of the mucous surface predisposes it to infection, but the mucous membrane acquires great toleration for mechanical irritation, and the fact that stones are not infrequently found at autopsy that have never produced any symptoms during life renders it probable that unless they act mechanically to produce stagnation of the bile by occlusion of the duct, and thus favor infection, it is more than likely that inflammation of the gall bladder will not occur. Infection by direct extension is suggested by Kotlar in the case of the so-called tuberculous disease of the gall ducts, which he believes is always secondary to a tuberculous focus in the liver.

The diagnosis of cholecystitis is ordinarily one of the most difficult problems presented to the clinician. Quincke and Hoppe-Seyler, who have written the most extensive modern monograph upon the diseases of the liver, state that in the majority of cases cholecystitis is either not recognized, or incorrectly diagnosed, and this may be said to be the general experience. I think it is safe to say that in the majority of hospitals an approximate diagnosis only is attempted, and too frequently when a case results fatally an autopsy either is not obtained, or else the clinician familiar with the symptoms is not present to direct the pathologist what examinations to make in order to find explanations for them. Fortunately there is reason to hope that in the course of time this difficulty will be partially obviated by the fact that the gall bladder and bile ducts are becoming more and more accessible to surgical measures, and therefore we may expect that in time the operation, which is often better for the sake of confirming or disproving the diagnosis than an autopsy, will enable clinicians to arrive at a degree of accuracy equal to that now attained in the diagnosis of appendicitis. At the present day the reasons for the difficulty of the diagnosis in these conditions are as follows: First, that the symptoms are exceedingly variable; this of course is perhaps due to the fact that the symptoms of inflammation are variable, and that the micro-organisms that may produce inflammatory conditions are numerous, and it is possible that they give

rise to slightly different symptoms, at least to different degrees of inflammatory reaction. Second, many cases are latent, a fact to which Minkowski calls particular attention, or at least give rise only to general manifestations. Third, and more important than this variability in the manifestations of cholecystitis, is the fact that other disease processes in the abdominal cavity give rise to symptoms that are indefinite, or not sharply localized, and are capable of being mistaken for affections of very different structures. The differential diagnosis, for example, between appendicitis and cholecystitis may be so difficult that even those with the greatest experience are liable to error. In fact, there is some reason to believe that the greater the experience the greater the doubt that may exist in the mind of the diagnostician, because he thereby becomes acquainted with the possibilities of variation in the manifestations of either disease. The obscurity is even more pronounced in cases of disease of the right kidney, or in inflammatory disease of the liver, or of the peritoneum in the neighborhood of that organ. In some cases even acute pancreatitis may simulate biliary disease so closely that the differential diagnosis is almost impossible. Finally, conditions may arise in the intestinal tract, particularly in the upper portion of the small intestine, which may cause considerable uncertainty, especially as enteritis in those situations is so frequently associated with disease of the bile ducts.

It will be impossible, in the limits of this paper, to enter upon any adequate discussion of the differential diagnosis of cholecystitis from conditions that may be mistaken for it. It will perhaps be better to present as clearly as possible the symptomatology of a typical case of acute suppurative cholecystitis, and to indicate the chief variations from this type.

From time immemorial jaundice has been considered characteristic of liver disease. Presumably in all forms of simple catarrhal cholangitis there is an inflammatory swelling of the mucous membranes of the biliary passages and of the gall bladder. This gives rise to the characteristic yellow color of the skin and sclera, the presence of biliary salts in the urine, clay-colored stools, a slow pulse, itching skin, mild digestive disturbance and slight fever. The symptoms are usually characteristic and the diagnosis easy. The course of the disease is mild and the prognosis favorable. When, however, there is reason to suspect some active inflammatory process, particularly if it is associated with empyema of the gall bladder either as a result of direct infection or on account of the presence of a stone, the diagnosis becomes much more difficult. The disease may commence with all the symptoms of peritonitis, and as a matter of fact peritoneal

effusion may be found at operation or autopsy before perforation of the wall of the gall bladder or biliary ducts has taken place, as in the case reported by Imhofer. The patient may suddenly go into a state of collapse and die before the real nature of the disease is suspected, or there may be slight fever, sweats and chills, without any distinct localizing symptoms such as pain or tenderness in the region of the liver. In general, however, there are certain symptoms and signs which occur so frequently, and are, taken altogether, so characteristic, that suspicion at least as to the true nature of the case should be excited. Of these the most important is pain. This is usually felt in the left epigastric region, is increased by movement, by any attempt to eat, and by vomiting. It may be sharp and lancinating, or distressing in character. It may come on suddenly, or gradually, following a preliminary stage of discomfort. Tenderness is nearly always associated with pain. It may be more pronounced at a point midway between the umbilicus and the seventh costal cartilage, although nearly always the entire hypochondriac region is sensitive. During palpation rigidity of the upper portion of the rectus muscle on the right side can usually be detected. The location of the tender point and of the rigidity is sometimes variable owing to the enlargement of the liver or of the gall bladder, or to displacement downward of the liver. The situation of greater tenderness may be at the level of the umbilicus, or even, in rare cases, somewhat below it, under which circumstances the differential diagnosis from appendicitis becomes increasingly difficult. When the abdomen is so rigid that it is impossible to outline the liver satisfactorily, it is almost impossible to make the differential diagnosis unless the examination is made while the patient is under the influence of a general anesthetic. The rigidity may involve the whole of the right side, or may, in severe cases, be general. Vomiting is nearly always a characteristic sign. It is usually persistent, accompanied by retching, and the vomitus ordinarily contains no bile, but consists—after the stomach contents have been evacuated—of a frothy material composed of mucus and saliva, and is usually alkaline in reaction. Constipation, as a rule, is obstinate. The administration of laxatives by the mouth only serves to increase the vomiting; enemata may be returned clear, or may bring away small masses of hardened feces. Occasionally careful palpation, especially if the patient's abdomen has been relaxed by an anesthetic or by opium, will reveal the presence of a smooth, rounded and perhaps faintly fluctuating tumor, appearing just beneath the lower border of the ribs, or in some cases lower down, depending of course upon the position of the liver. Pressure upon this may be painful or absolutely painless. Puncture

of this tumor to determine whether it is actually the gall bladder, and if so whether or not pus is present, excepting as an immediate preliminary to an operation as suggested by Minkowski, is, in Quincke's opinion—which I heartily share—so dangerous that it is wholly unjustifiable. The possibility of feeling a nondistended but inflamed gall bladder by deep palpation with the tips of the fingers, as has been suggested by Pollatschek, may well be doubted. If localized peritonitis has occurred there may be slight edema of the skin over the hepatic region.

The general symptoms are of great importance because they serve to indicate the gravity of the disease. Fever is often ushered in by a chill, and the chill may be repeated frequently at irregular intervals. The fever is ordinarily hectic or remittent in type, rising in the evening or falling in the morning, the fall being associated with sweating. Sometimes it is extremely irregular in character; occasionally it is persistently high, and in rare cases, usually of the most fatal nature, absent and replaced by a subnormal temperature, as in the case reported by Guyot. In some cases it is distinctly periodic, simulating malarial disease, particularly when there is obstruction of the common duct. The patient usually presents all the symptoms of extreme prostration: The pulse is rapid, feeble and small, the expression is anxious, the mouth is dry, not infrequently there is delirium, usually of the low, muttering type, and incontinence of urine. Sometimes the spleen may be palpated in the left hypochondriac region, and usually the leukocytes are greatly increased in number, ranging between 15,000 and 30,000, and showing a preponderance of the polymorphonuclear forms. Jaundice is comparatively rare; occasionally there is a slight icteroid tint of the sclera; and not infrequently a small amount of urobilin may be detected in the urine. The method of Hay, which consists of scattering flour of sulphur upon the surface of the urine and noting whether it floats or sinks, the latter indicating the presence of urobilin, is of service in this condition; my own experience has confirmed its value. The history of the case will often throw considerable light upon its nature. If the patient has had typhoid fever, or has had one or more attacks of biliary colic, or if in addition to the other symptoms there is evidence of jaundice, the diagnosis is rendered more likely. The discovery of gall stones either in the discharges or by the X-rays¹ may aid in the diagnosis.

In rare cases the diagnosis may be cleared up by the occurrence

¹ Compare Fournier and Siegel for opposing views on this question. The prevailing opinion is decidedly against the possibility of seeing gall stones with the X-rays.

of certain extraordinary symptoms. In a case reported by Robson there was distention of the ascending colon with collapse of the descending colon and extreme distention of the gall bladder, indicating some obstruction at the hepatic flexure, which was found to be due to an inflammatory process of the bile ducts. In a case reported by Hayem gall stones were observed in the vomit. In one reported by Ravaut there were symptoms of thrombosis in the ascending cava and in the portal vein, giving rise to extreme edema of the lower extremities and severe ascites. At the same time there was, in this case, extreme tympanites. Indeed, a thorough discussion of the diagnosis of cholecystitis would involve citing the reports of a great number of individual cases.

Complications of the most serious nature may of course occur. Among these are single or multiple abscess of the liver, as in the case of Ravaut; the formation of the subdiaphragmatic abscess with rupture into the right pleural cavity, and into the lung, as in the case reported by Thirolaux. Peritonitis is so common that it can scarcely be considered a complication. In a case reported by Chiari it was associated with necrotic cholecystitis.

A most serious complication, and one that is difficult to diagnose, is rupture of the gall bladder. From the infrequency with which I have been able to find mention of this in the literature it must be of exceedingly rare occurrence. Hochenegg reports a case in which it occurred spontaneously apparently as a result of overdistention. Machard mentions a remarkable case in which an adhesive peritonitis attaching the gall bladder to the skin caused rupture of the former. On two occasions, before rupture occurred in this case, there was acute dilation of the gall bladder, apparently due—as the autopsy showed—to bending of the cystic duct, the gall bladder on both occasions appearing as a large tumor in the epigastric region. During the second attack there was severe pain, and the patient went into a state of collapse, dying the following day. At the autopsy an empyema of the gall bladder was found, associated with purulent infiltration of the bladder wall and perforation of the posterior surface. A stone was found in the cystic duct, and although Machard considers it a secondary factor, it is not unlikely that it may have acted as a ball-valve obstructing the common duct. A remarkable case of this nature came under my own observation.

The patient, a woman of 50 years, had had for about eight years severe but somewhat variable jaundice. This was associated with occasional pain in the left hypochondriac region, constipation with clay-colored stools, hemorrhagic diathesis and, toward the end, considerable digestive disturbance. When I first saw her the patient was profoundly anemic; the liver was not

palpable, but a small elastic mass could be felt just below the border of the ribs. The condition of the patient was so bad that although operation was considered, in the absence of active symptoms it was deferred. The subsequent course of the case was as follows: The patient remained in about the same condition for several days, the tumor being distinctly palpable; then, as she described it, she had a sensation as if something had given way in the abdomen, although there was no acute pain, and the tumor disappeared completely. At the same time dulness appeared in both flanks, and there was evidence of an accumulation of fluid in the peritoneal cavity. The patient was practically moribund, and in deference to the wishes of the family operation was not performed. She remained alive for three days without fever, but with a progressively weakening pulse, until she died.

At the autopsy, which was performed under difficulty at a boarding-house, some interesting lesions were found. The peritoneal cavity contained a considerable quantity of bile-stained fluid; all the tissues were profoundly anemic; the heart muscle was pale and soft; the liver was contracted, granular and dark-green in color. The gall bladder was collapsed and had in its fundus a small tear corresponding to an ulceration of the mucous membrane. Elsewhere the mucous membrane was thickened, pale and rough; the common, cystic and hepatic ducts were so enlarged that they readily admitted the passage of my index-finger. A probe was readily passed through the diverticulum into the duodenum. In the common duct a smooth round stone about the size of a hazelnut was found, which was freely movable. No stones were found in the peritoneal cavity or in the gall bladder. The stone in this particular case acted undoubtedly as a ball-valve, and from time to time caused complete biliary obstruction as a result of its pressure against the orifice of the duct by the bile secreted behind it. The long course of the case had made it possible for biliary cirrhosis to occur, and finally, for some unexplained reason, probably as a result of stagnation of the bile, the gall bladder became infected and cholecystitis ensued, followed by perforation and death. Unfortunately, at the time of the autopsy it was impossible to make cultures, and therefore it is not certain what the nature of the infection may have been.

Occasionally in cholecystitis secondary to cholelithiasis, perforation occurs into some neighboring organ through an adhesion that has been formed by a pericholecystitis. In these circumstances the only method by which a diagnosis can be made is the discovery of stones in the feces so large that it is not reasonable to suppose that they could have passed through the papilla into the duodenum; indeed, it is likely the largest stone that can so pass does not exceed a pea in size. Sometimes perforation may take place into the stomach, and then, as in the case described by Hayem, stones may be found in the vomit, or in the stomach at autopsy. I performed an autopsy on a case of this kind that had been under Dr. Musser's care in the wards of the University Hospital. The patient had had all the symptoms of

pyloric carcinoma, and at the autopsy a carcinoma was actually found involving the lower portion of the stomach, which was apparently secondary to an ulceration produced by a large stone which had worked its way through the duodenum and gall bladder into the stomach. A fibrous stricture was found about the middle of the duodenum. A somewhat similar case has been reported by Dupré. An interesting illustration of the difficulties of diagnosis was a case that came under my observation.

A man over 70 years of age had had repeated attacks of indigestion. His heart had been rather weak for years. About three months before his death he had a slight attack of jaundice, which led to strong suspicion of the presence of gall stones, although there was no history of biliary colic. From this he recovered, but two months later had a second attack with considerable pain in the right hypochondriac region. He developed fever and finally died, apparently of exhaustion. At the autopsy the gall bladder was found filled with numerous small stones, and the common duct was obstructed by a stone about the size of a hazelnut. The duct was dilated so that it readily permitted the entrance of the index-finger. The gall bladder and the bile ducts contained a considerable amount of mucopurulent material.

The symptomatology of cholecystitis, therefore, although sufficiently characteristic in typical cases, is sometimes so obscure that a certain diagnosis is impossible. It is particularly important, however, to use all precautions in making a diagnosis, especially in those cases in which the history leads to the suspicion of infection of the gall bladder. It is altogether probable that the tenderness in the right hypochondriac region which often occurs in typhoid fever is due to infection of the gall bladder, and all patients who have had attacks of colic and who develop fever, especially if associated with slight jaundice, should be regarded, in the absence of other adequate explanation, as examples of this condition. The importance of accurate diagnosis, in view of the fact that the only treatment is surgical, cannot be too strongly urged.

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The Surgery of Cholecystitis.

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I was asked to briefly discuss the subject of the surgical aspects of inflammation of the gall bladder, saying something, I take it, of symptomatology, but more of diagnosis and treatment. The allotted time is so short that the paper must of necessity be incomplete and superficial. In view of the fact that the title thus limits the subject, it is not necessary to dwell upon the essential causes of cholecystitis, upon the routes of bacterial invasion, or upon the forms of micro-organisms which may be present. It is sufficient to say that various bacteria may, at times, invade the gall bladder, the most common being colon bacilli, typhoid bacilli, pneumococci and pus germs, and there may be one variety only or there may be mixed infection.

Further, although these bacteria may enter the gall bladder, when the flow of bile is unobstructed and there is absolutely no block to the drainage of the sac, they rarely do harm and usually die. Bacteria which do not apparently at once establish inflammatory changes may

become the nuclei of gall stones. It seems that the same variety of germ may, under some circumstances, be responsible for a catarrhal inflammation, and, under different circumstances, a suppurative inflammation—in other words, when the bacteria are of full strength and tissue resistance is at a low ebb, suppurative cholecystitis results; and when the bacteria are mild or attenuated and tissue resistance is at a high level, only catarrhal inflammation is produced.

The important point to bear in mind is that stagnation of the bile strongly favors infection, but it is likewise necessary to recall that infection may be the cause of stagnation. These two influences favor each other, and each one intensifies the other; the fact is, it is possible that infection of the gall bladder only becomes serious when the bile is stagnated.

Catarrhal inflammation of the gall bladder and bile ducts—what is known as acute or chronic catarrhal jaundice—is a condition which belongs, as a rule, to the province of the physician; although, as Mayo Robson has pointed out, we must remember that a chronic catarrhal jaundice may resemble a jaundice produced by organic disease or may be associated with some such condition as gall stones, cancer or hydatids. Therefore, when in such a case medical treatment has proved futile, surgical treatment must be considered.

What is known as catarrhal cholecystitis is a chronic catarrhal inflammation of the gall bladder, unassociated with jaundice; and the diagnosis usually made is cholelithiasis. In this condition the gall bladder becomes thickened, and is frequently thrown into folds and pouches. The mucus which is secreted is very thick, and accumulates in masses; and the descent of these semisolid plugs may lead to blocking of the cystic duct or may produce attacks not to be distinguished from attacks of gall stones. In such cases the gall bladder, as a rule, is distinctly distended, but hardly to a sufficient degree to permit of palpation. Furthermore, as Robson points out, if gall stones have not been present, there are no adhesions to surrounding structures. The condition above described may have resulted from gall stones which have passed away or may be associated with the presence of gall stones.

I recently operated upon a case under the supposition that gall stones existed. On opening the abdomen a large, thick and non-adherent gall bladder was discovered. The mucous membrane was thrown into folds and convolutions; the cavity of the bladder was filled with thick, tenacious mucus; and here and there in the mucous membrane of the gall bladder were minute concretions. The patient was cured by extirpation of the mucous membrane and subsequent drainage, a plan that has been advocated by Mayo, of Rochester, as

a substitute for cholecystectomy. In this case it seems probable that stone-formation was following upon catarrhal cholecystitis.

In another case there had been violent symptoms of gall stone colic in a woman of some forty years of age, and several stones had been recovered from the feces. Opening the gall bladder failed to disclose any gall stones, but showed a condition of catarrhal cholecystitis.

Jaundice does not often appear in catarrhal cholecystitis when gall stones are not present. Very rarely, however, it is noted; but in such a case it is trivial and transitory. The attacks of pain to which people with catarrhal cholecystitis are liable are similar to those met with in persons with gall stones; but the pain due to the passage of a plug of mucus is much less severe and much briefer than that due to the passage of a gall stone. Again, as already mentioned, jaundice is not apt to ensue in the first case; and besides, as Robson has pointed out, in cholecystitis there is usually some tenderness on pressure in the gall bladder region, whereas this is absent in uncomplicated catarrhal cholecystitis.

In the majority of cases catarrhal cholecystitis is curable by medical means, but in a very large minority medical means will fail. In such cases we shall probably be uncertain whether or not we are dealing with gall stones, but an operation is indicated in either case. The operation of cholecystotomy is performed, the gall bladder is drained for a week or more, and this treatment will almost invariably produce a cure.

Croupous inflammation of the gall bladder and the bile ducts is an extremely rare condition. It is due to the formation of a thick or membranous material in the bile passages, which causes biliary obstruction and consequent spasmodic contraction of the gall bladder. The symptoms are practically identical with those of gall stones. Mayo Robson says that an examination of the evacuations may discover membranous intestinal casts; and, as membranous enteritis is usually associated with croupous inflammation of the gall bladder and bile ducts, we may thus reach a diagnosis. It may even be that we will be able to find in the evacuations a cast of the gall bladder. If medical treatment fails to cure such a condition, the operation of cholecystotomy should be performed, and drainage should be employed for a considerable time.

When bacteria of greater virulence are introduced, or when tissue resistance is at a low ebb, one of a number of conditions may arise. We may have a simple empyema of the gall bladder; we may have that dangerous condition known as acute phlegmonous cholecystitis, with or without gangrene of the gall bladder; we may have infective

cholangitis, suppurative cholangitis and ulceration of the gall bladder. Besides these definite diseased conditions, there may be most disastrous consequences: perforation into the peritoneal cavity, into the gastro-intestinal canal, into the retroperitoneal tissues, etc.; the breaking of an infected area into the portal vein; the development of an hepatic abscess; pericystic abscess; the formation of dense adhesions; the extensive destruction of mucous membrane; the conversion of the gall bladder into a mass of fibrous tissue; and so on.

What will particularly strike us, however, is the similarity which the possible changes of acute cholecystitis bear to the possible changes of acute appendicitis. In each structure there may be a catarrhal inflammation, which progresses no further than this, or which advances into some more dangerous form; in each structure blocking or stagnation favors infection and greatly aggravates existing infection; in each there may be suppuration, there may be ulceration, there may be gangrene and perforation, there may be complications and consequences the most disastrous and fatal; and in each, it may be added, prompt surgical intervention is usually life-saving.

When a catarrhal cholecystitis eventuates in suppuration, we have the condition known as simple empyema of the gall bladder, a condition which is rare, unless gall stones are present, or unless typhoid fever exists or has existed. When a gall duct is blocked with mucus or swollen mucous membrane, the condition is known as hydrops, and in hydrops the gall bladder is distended with mucus or altered bile. When hydrops undergoes suppuration, simple empyema is produced. In the mild condition of suppurative catarrh or simple empyema, we remember, the vast majority of cases are associated with gall stones; hence, in the great majority of cases there is a history of a number of attacks of biliary colic. The pain finally becomes persistent, instead of intermittent, and a definite swelling is detected in the gall bladder region. This swelling is tender on pressure. In most cases there are definite constitutional symptoms; in many cases the symptoms are slight; in some they are severe.

The slight symptoms are some elevation of temperature, a rather rapid pulse and a tendency to nocturnal sweating; the more severe symptoms are chills and a remittent fever, with profuse sweats. When we have the mild symptoms, the case is one of simple empyema; when the more severe symptoms are present, some dangerous change is taking place—most often ulceration of the gall bladder.

In simple empyema the patient usually shows advancing loss of flesh, the appetite is poor, and there is considerable thirst; but very rarely is there distinct jaundice. In cases of simple empyema, as in those of ordinary catarrhal cholecystitis, an enlarged gall bladder

may be mistaken for a displaced kidney. As Henry Morris has pointed out (*British Medical Journal*, 2, 2, 1895), movable kidney and enlarged gall bladder are each most frequent in women; the right kidney is vastly more apt to be movable than the left, and we may find a movable kidney and an enlarged gall bladder in the same individual. In each there is a tumor in the right hypochondriac region, extending also into the umbilical region. It is likewise true that the enlarged gall bladder, like the enlarged kidney, can in some cases be pushed backward toward the loin, or even to the left of the middle line.

Henry Morris lays down the following rules, to enable us to differentiate these two conditions: He says that we should remember, first, that an enlarged gall bladder, as well as an enlarged kidney, is a common cause of movable abdominal tumor. Second, we should always ask whether there has ever been a definite attack of jaundice. Third, an enlarged gall bladder can invariably be palpated, whereas a movable kidney, unless it is enlarged, cannot always be felt; at times it is detected easily, at other times it is obscured, and sometimes it may not be found at all. Fourth, the fact that the tumor varies in size at different times bears no part in the diagnosis, unless with diminution of swelling there is notable increase in the amount of urine. Fifth, a gall bladder containing stones feels a great deal harder than a movable kidney. Sixth, the study of the mobility shows that however freely a gall bladder may move, this movement is invariably in the arc of a circle, the center of which circle is beneath the edge of the right lobe of the liver. An enlarged gall bladder cannot be pushed down toward the pelvis, unless the liver is likewise movable; a movable kidney moves practically in all directions, and can often be made to pass between the examining fingers, and it also has a strong tendency to return to its proper position in the loin. If an enlarged gall bladder be pushed into the loin, it will not remain there, but will instantly spring out; if a movable kidney be pushed into the loin, it tends to stay in that position. Other points are made in diagnosis—especially the relation of the colon to the tumor, which, however, does not furnish altogether reliable indications.

If simple empyema is opened and drained at an early period by the operation of cholecystotomy, a cure can usually be readily effected. After the gall bladder is exposed, it should be surrounded with gauze pads, a quantity of fluid should be evacuated by means of an aspirator, an opening should be made, the viscus should be irrigated with salt solution, a search should be made for the obstructing cause in the cystic duct, and this cause should be removed; in some cases it will be found that the walls of the gall bladder are so softened that we

cannot stitch them to the abdominal wall, and in other cases it will be found that there is beginning ulceration of the gall bladder or disseminated abscesses through its walls. In such a case, cholecystotomy with drainage is the proper operation.

In some cases, again, a pericystic abscess is found, the micro-organisms having passed directly through the gall bladder. When a pericystic abscess exists, the operation is often difficult and dangerous. Senn, in some of these cases, advises that we first drain the abscess, and then after a time open and drain the gall bladder. Mayo dissents from this view, and advocates an immediate radical operation.

Occasionally we find a condition which may be called recurrent simple empyema of the gall bladder. An individual develops pain and fever, tenderness and tumor, at intervals; and then the symptoms clear up, only to recur, until finally they become persistent or very severe, because of the development of some complication. In these cases, after a time the tumor ceases to be manifest during the attack; and when an operation is performed, a small, deeply placed gall bladder may be found—a gall bladder which contains purulent fluid, and is adherent to and hidden under the surrounding organs. In such a case Senn advocates the operation in two stages, although Mayo and some other operators oppose it even then.

Acute phlegmonous cholecystitis is an extremely serious condition which is apt to eventuate in gangrene of the gall bladder. It is called by some acute empyema. In this condition there may be rapid peritonitis and death, even without perforation of the gall bladder walls; but in many cases, just as in appendicitis, the gall bladder walls may be perforated. It is usually associated with the presence of calculi, but may arise when no stones are present; and in some cases the cause seems to be a fever, like typhoid or septicemia. The disease comes on with sudden and violent pain in the gall bladder region—a pain which frequently radiates to the right shoulder, and which quickly becomes generalized throughout the abdomen. There is tenderness, great rigidity—most distinct over the region of the gall bladder—thoracic respiration, exhausting vomiting and septic fever; and unless the surgeon interferes, general peritonitis soon destroys the patient. In some cases jaundice is present; in many it is absent. In the less severe forms pericystic abscess develops, and is localized by adhesions; in the more severe ones there is no attempt at limitation of the infection.

In one case of this disease on which I operated in the Blockley Hospital, a large gall stone was impacted in the cystic duct. There was intense jaundice, tenderness, violent pain, marked abdominal distention and rigidity, chills and septic fever. When the abdomen

was opened, it was found that a portion of the gall bladder was gangrenous, and that a calculus was projected through the gangrenous opening. An attempt was made to perform cholecystectomy, but the patient's condition was so desperate that it was not persisted in. The infected gall bladder, after the stone had been removed, was packed about with iodoform gauze. This patient recovered from the operation, but died some weeks later because of cardiac complications.

It is this form of cholecystitis that is particularly apt to be mistaken for appendicitis. I of all men do not care to be dogmatic. I have in certain cases failed to make a correct diagnosis. I operated upon a gall bladder case thinking it appendicitis, and upon a case of appendicitis thinking it gall bladder disease. The situation of the primary pain is of importance in the diagnosis, and likewise the situation of the tenderness, but a displaced gall bladder or an abnormally situated appendix will deceive us. A fact to bear in mind in the diagnosis is that usually in acute phlegmonous cholecystitis there is absolute constipation; and when we recall the sudden onset and the abdominal distention, we may mistake the disease for obstruction of the bowels. Furthermore, acute phlegmonous cholecystitis may be confused with perforation of the stomach or duodenum. In any case of doubt, an exploratory incision should be promptly made. When an operation is performed the gall bladder should, whenever possible, be extirpated, it being just as important to do this as it is to extirpate a gangrenous appendix. If extirpation cannot be performed the gall bladder should be surrounded with strands of iodoform gauze and a drainage tube should be carried well toward the cystic duct.

In regard to the other inflammatory conditions in this region—conditions which involve the bile ducts, as well as the gall bladder—I have not the time on this occasion to speak; and I therefore cannot dwell upon those important subjects, infective cholangitis, suppurative cholangitis and the various consequences of inflammation, particularly perforation of the gall bladder, the formation of adhesions and obliteration of the gall bladder; nor am I able to take up those interesting changes which result in the pancreas from blocking of the bile ducts.

In endeavoring to make a diagnosis of a condition in which we believe the gall bladder to be affected, we must palpate with great care. The patient should be in the recumbent position, the legs and thighs should be flexed, and the head and shoulders should be raised upon a pillow. The patient must be told to breathe quietly and regularly. As Bevan has pointed out, the first thing to do is to feel for and find the edge of the liver, and to seek for the gall bladder underneath this, using light pressure. If the tumor is discovered,

it is outlined, it is noted whether or not it moves with the liver on respiration, its movability and consistency are determined, and it is subjected to percussion. In some doubtful cases the colon must also be distended with air or hydrogen gas, in order to make out its relation to the mass.

In some of these gall bladder cases the question comes up whether we shall or shall not do an operation in two stages. In the two-stage operation there is undoubtedly less risk of infecting the peritoneal cavity; but by this operation we put aside the possibility of examining properly the cystic duct and the common duct for diagnostic purposes. In most instances I prefer the operation in one stage.

The operation of cholecystectomy is justly becoming more popular. It should be employed much more frequently in infective conditions than it has been, although in some cases Mayo's method of extirpating the mucous membrane may be used as a substitute.

Medical Treatment of Cholecystitis.

BY SOLOMON SOLIS COHEN, M. D.

Concerning the conditions that have been so carefully and admirably described by the writers of the various papers in which there is suppuration in the gall bladder, in which there is perforation, in which there is hydrops, in which there is gangrene and the like, I believe there is no medical treatment. The only procedure is to find the best surgeon and turn the case over to him.

In the conditions that may precede these severe stages, the difficulty in outlining treatment is purely a difficulty of diagnosis. That has been admirably pointed out by Dr. Sailer. I have never seen a case in which I have been able to make a diagnosis of isolated catarrhal cholecystitis. Therefore, I do not know how such a case would impress me from the standpoint of treatment. Cases of catarrhal jaundice, cases of gastroduodenal catarrh associated with more or less inflammation of the bile ducts and gall bladder, cases of cholelithiasis associated with inflammation or irritation of the gall bladder and cases of similar nature frequently come under the notice of the physician and are at times amenable to hygienic and medicinal measures. These are, however, sufficiently familiar to the members of the society and to the profession in general.

The treatment is partly regiminal. It partly consists in measures

of cleanliness, washing of the stomach and bowel and the use of such drugs as calomel and sodium phosphate to effect the discharge of mucus. In cases in which there is inflammation of the bile vessels, a cholangitis, with or without fever, with or without decided jaundice and tenderness, the patient should be put at rest, his diet should be regulated, mild laxatives and such drugs as are supposed to, and in some cases do, more or less dilute the bile or increase the flooding of the bile channels, as the salts of sodium, the mercurials, and especially mercury bichloride should be administered. In cases in which the gall bladder contains or seems to contain one or more stones which from time to time give rise to colic, the treatment is largely regimenal.

Among the medicinal agents, however, I should like to take opportunity to call attention of the Society to a drug which, so far as I know, was first prescribed by Dr. Ellwood Wilson, sodium succinate. It has been used with apparently good results, and in one case its administration was certainly followed by the discharge of a large number of small gall stones and in this case they were of that somewhat uncommon variety, the white gall stones, so that they were at first mistaken by the patient for some quinine pills that had been taken. It is usually given in doses of five grains, four or five or more times daily.

The various bile preparations are also used with good results to overcome inspissation. Many physicians still lay stress upon the cures of spa treatment, especially of Carlsbad, and quote large numbers of cases of cholelithiasis in which complete cure has been effected by a systematic course of treatment at home with these waters. In sluggish cases, with patients of torpid constitution, the thermal waters; in cases of plethoric, overnourished individuals, the cold waters are of value. The artificial salts are easily prepared and may be given in hot or in cold water according to circumstances. In addition, in some of these cases, hydrotherapy to stimulate the general metabolism, and the activity of the bile ducts and the kidneys will sometimes assist in overcoming the catarrhal conditions and in that way prevent the occurrence of the serious complications of which we have heard. Among these are the familiar cold and hot wet packs, the cold effusion and douching, massage and other measures that stimulate the bodily functions generally. But there is no specific treatment for cholecystitis; it is a general attempt to secure cleanliness of the stomach, the intestine and the hepatic ducts, and to stimulate the hepatic function.

After successful surgical intervention even if the gall bladder be removed or obliterated, the same principles of treatment apply to prevent recurrent catarrh of the biliary passages.

DISCUSSION.

DR. J. C. WILSON said that it is particularly evident from the consideration of the anatomicopathological conditions of the gall bladder and gall ducts that 2 entirely separate pathological states are dealt with; one, arising from an inflammation of these structures independently of gall stones, cholecystitis, cholangitis; the other, from the presence of gall stones in the gall bladder or some part of the bile passages. These 2 conditions often coexist and it is well to remember that conditions presenting characteristics of gall bladder disease and of gall stone disease may be produced by 2 entirely different pathological products, tough, tenacious mucus and gall stones. The differential diagnosis, therefore, between cholecystitis or cholangitis, which under certain circumstances, may produce colicky symptoms precisely analogous to those produced by gall stones, is in some cases impossible. The recognition of this fact is important because until the differential diagnosis can be made, various points of treatment, and particularly the surgical treatment, must be the same for both conditions. There are 3 common conditions affecting the gall bladder the result of inflammatory changes in its mucosa and of the adjacent parts; namely, catarrhal cholecystitis, which is most frequent; suppurative cholecystitis, which is less common, and phlegmonous cholecystitis. The first, the most common, he has recognized more frequently than formerly since his attention has been especially attracted to it. He has seen it in enteric fever, in which disease he has come to associate it with a tendency to relapse. He referred to a case of enteric fever in which the occurrence of cholecystitis was indicated by symptoms of pain on pressure in the region of the gall bladder and dullness on percussion. In this case he thought there was a probability of relapse and he was not mistaken. As a rule, in catarrhal inflammation of the gall bladder, such as is frequently seen in cases of enteric fever, recovery takes place. He referred to Courvoisier's law, that a single stone in the gall bladder may bring about contraction of that organ, whereas, on the other hand, a considerable collection of stones usually results in more or less distention of the gall bladder. He is inclined to join the ranks of those who advocate early surgical operation in cases of repeated attacks of biliary colic. He reached this conclusion from his experience, and his knowledge of cases that show the ease of early operation, with relief of symptoms and the absence of danger from hemorrhage, and of other cases that show the difficulties of late operation, with the presence of grave danger from hemorrhage.

DR. JOHN H. MUSSEY said that he hoped that the idea would not prevail that all the forms of infection of the gall bladder are chiefly due to infections other than those associated with gall stones. His own experience was that the most frequent forms of gall bladder infection were associated with gall stones. There are cases of inflammation, however, that are due to the bacillus typhosus, the pneumococcus, the colon bacillus and other micro-organisms from the intestinal tract. We must remember also the occurrence of infection in association with carcinoma. In one of the first cases of carcinoma of the gall bladder that he had seen there was infection with chills and fever. The patient died and the autopsy showed carcinoma of the gall bladder, gall stones

and suppurative cholecystitis. In the Philadelphia Hospital he had seen many cases in old men and old women. Among these there had been, contrary to the usual rule, more cases among the men than the women. In private practice and in other hospitals, however, the majority of cases occur in women. The symptoms are those of cholelithiasis and local infection, with the occurrence of obstruction at intervals. In a case under his observation last year the patient, in whom there was a previous history of biliary calculi, had cholecystitis of severe degree associated with jaundice. For a time there was complete recovery from the cholecystitis. Operation for gall stones was subsequently done. There was no evidence of cholecystitis at the time, except in the adhesions around and outside of the gall bladder that attached it to the pylorus of the stomach. There were an abundance of gall stones. Such cases frequently terminate in perforation. He had seen but 2 or 3 cases of cholecystitis associated with typhoid fever. The condition may be easily overlooked in old subjects, in whom it is so often difficult to palpate the gall bladder; in subjects in the later stages of typhoid fever when there are few local symptoms; in cases of typhoid septicemia, after the specific symptoms of typhoid have disappeared, but the fever continues and the patient has ultimately died from exhaustion. In such cases he would look more carefully for the local phenomena and, in the absence of signs of infection elsewhere, particularly if the specific symptoms of the disease have subsided, he would urge an exploratory operation, which he considered, under the circumstances, fully justifiable. He thought that the cases of pneumonia that had formerly been mistaken for gall stones were, in reality, cases of pneumococcus infection of the biliary passages coincident with infection of the lungs. He thought that there was more difficulty in differentiating pancreatitis from cholecystitis than from any other condition. There is also considerable difficulty in the differential diagnosis between cholecystitis and appendicitis. He pointed out that in pancreatitis the symptoms were chiefly in the epigastrium rather than to the right of the median line and that they are associated with a tympanitic tumor. There may be physical signs in the pleura posteriorly and signs of effusion in the lesser peritoneal cavity. There is displacement of the heart and interference with the excursion of the diaphragm on the left side. He referred to an illustrative case.

Dr. Ernest Laplace said, that the time is not far distant when the finding of a gangrenous appendix or a gangrenous gall bladder will be unknown; the diagnosis will be so precise that the disease will be removed before gangrene sets in. To allow several attacks of colic to take place would in the future be as rare and improper as to do an amputation for compound fracture.

DR. G. G. DAVIS said that the question of treatment of cholecystitis is now where the question of treatment of appendicitis was some years ago. He favors the plan of operation suggested by Mixter, inserting a glass drainage tube and having it come to the surface.

DR. JUDSON DALAND said that the presence of bile in the blood not only produces hemorrhage but also delays the healing of a wound. In cases of well marked jaundice extending over a period of 5 or 6 months the probability is that the surgical wound will not heal, that hemorrhages will ensue and that the termination will sooner or later be fatal.

DR. JOHN B. DEEVER said that experience at the operating table had convinced him that early operation is indicated in cases of acute cholecystitis and of gall stones. In some cases it is wise not to stop with drainage but to go on to removal of the gall bladder.

DR. WILLIAM E. HUGHES emphasized the fact that there are a large number of infections of the gall bladder without gall stones. This would indicate that the first step toward the formation of gall stones was the infection. In a case of cholecystitis without gall stones, such as occurs in typhoid fever and in other infections he would not advise surgical treatment. He had treated a number of such cases and had never seen one die. A phlegmonous or gangrenous condition of the gall bladder is an exceedingly grave affair, almost absolutely fatal. It is a surgical condition if the diagnosis, which is however, exceedingly difficult, can be made. The mistake of calling it intestinal obstruction would probably be more frequently made than any other. Occasionally a diagnosis in this condition may be made of some pancreatic lesion. Gall stone disease is especially a surgical affair. Given a diagnosis of gall stones, it is futile to treat the case medically. Cholecystitis, not due to or associated with gall stones, is at the present time unquestionably a medical affection.

Excision of the Cecum with Portions of Colon and Ileum.

By C. F. NASSAU, M. D.

[Exhibited March 12.]

The patient is a man, 46 years old, a native of Denmark, who was admitted to St. Joseph's Hospital on the morning of January 23. The case was found instructive because an entirely correct diagnosis was not made. The man had been somewhat of a wanderer on the face of the earth, having twice sailed around the world in different directions. He had suffered with chronic indigestion for some years and "lately he had felt something in his stomach." His temperature when first seen was between 102° and 103°; his pulse was rapid; he was emaciated and altogether was a very poor looking specimen of a man. He had a great deal of tenderness in the right iliac fossa and a large mass was evident on inspection and superficial palpation. A diagnosis of appendicitis with abscess was made and at operation, which was done on the same day, an attempt was made to make an incision parallel to and above Poupart's ligament in order to avoid opening the general peritoneal cavity and to rupture the abscess externally. This effort failed. After evacuating some 300 or 400 cubic centimeters of pus it was found that no impression had been made on the tumor itself. This was broken into and was found to resemble either tuberculous or sarcomatous material. An incision was then made as near the midline as possible, the intestines packed off, except those that were adherent. Bowel could be recognized with difficulty in this rotten mass at points on the ascending colon and ileum. The parts were so greatly matted together that it was doubtful, in Dr. Nassau's

opinion, whether any mechanical appliance would be of value. Nothing but a needle and thread seemed to be of use. Both ends of the bowel were anchored down and the condition was bad. About 8 inches of the bowel including the cecum were removed. The man has improved and is now fairly stout. There has been no leakage from the point of union. A diagnosis of sarcoma was made. The after treatment was of interest in that it was necessary to give the man 2 drops of croton oil with 3 or 4 ounces of salts after calomel before a satisfactory bowel movement was obtained. The movement of the bowels had subsequently become normal.

DISCUSSION.

DR. A. J. DOWNES said that he had seen a case of uncertain diagnosis and had operated on the patient for appendicitis. The patient, a woman, had been examined under an anesthetic. At the operation 6 inches of a tuberculous cecum were resected. Fistula developed in his patient, who died some months subsequently of acute tuberculosis of the lungs. When the ends of the bowel are bound down, he thinks better results follow immediate suture than follow the employment of mechanical apparatus.

SYMPOSIUM ON DYSENTERY.

[March 26.]

Tropical Dysentery with Abscess of Liver, Rupture into Right Lung, Ameba Coli in the Sputum. Exhibition of Case.

BY L. NAPOLEON BOSTON, A. M., M. D.

The patient whom I am privileged to present before the Society is a male, aged 21 years, who enlisted in the United States Army during the Spanish-American war and was assigned to duty in the Philippines. He was in perfect health on arriving at Manila December 22, 1899. On January 15, 1900, he was taken to the hospital for malaria, but reported for duty February 3. Between February and August he returned to the hospital on 3 or 4 occasions on account of dysentery, and during each attack his stay in the hospital was 2 or 3 days.

On August 2, 1900, he returned to the hospital suffering from dysentery, and was not discharged until the latter part of the month, at which time he weighed 95 pounds, having lost 40 pounds in 4 weeks. On the day of his admission he had 28 stools, all of which contained some blood. Bowel movements were frequent throughout the greater part of the month, but they were reduced to from 3 to 6 daily until September 10, when he was assigned a light grade of duty. The patient states that large, hard, nodular masses were palpable over the abdomen, and that when these masses were present the pain was unbearable. They disappeared after free evacuation of the bowel to reappear whenever the bowel became loaded with the offending material.

Rectal pain and tenesmus were prominent symptoms. Constipation was not present at any time during his illness, nor did he ever notice that he passed scybalous masses. After leaving the hospital he improved rapidly and remained in good health, returning to the United States June 27, 1901. I was privileged to make a physical examination of the patient during September last, when his lungs presented nothing abnormal.

I was called to see him February 4, 1902 (8 weeks ago), at which time an abscess ruptured into the lung, when he presented many symptoms common to lobar pneumonia; the onset being ushered in by 2 distinct chills. The expression was anxious, cheeks flushed, respirations rapid, 30 to 40 per minute; pulse full and bounding, 90 to 110; cough accompanied by free, bloody expectoration, and both dull and lancinating pains at the base of the chest. There were profuse drenching sweats, and the temperature was subnormal, 98° F.

The history obtained was that during the past 3 months he had been subject to paroxysmal coughing each morning, accompanied by free expectoration; but it was not until within the last month that the sputum was blood-streaked. Until the day previous to my seeing him the cough, though severe, did not excite pain, and while he became easily exhausted, experiencing a feeling of oppression over the liver, he was able to attend to his duties as a shipping clerk until the day of my first visit, when he was compelled to take to his bed.

Physical Examination.—Inspection of the chest and abdomen revealed nothing abnormal.

Palpation elicited an area of tenderness in the epigastrium which was bounded, on the right, by the costal margin, and on the left, by the median line. The edge of the liver could be felt on deep pressure.

Percussion gave a resonant note over both apices and over the entire left lung. Over the right lung the note became impaired at the fourth interspace, in the mammary line, and increased, blending with liver dulness, which extended to the costal margin. In the mid- and posterior axillary lines the note was slightly impaired, and the area of liver dulness protruded into the epigastrium.

Auscultation gave many both fine and coarse crackling rales over the base of the right lung; the breath sounds were rather harsh but at no time did they present a bronchial element. The heart sounds were distinctly audible over the base of right lung. Left lung and heart normal.

February 24, 1902. Infra- and supraclavicular regions showed decided depressions on the right side, and the right clavicle was prominent. Expansion appeared somewhat restricted over the right lung.

Mensuration: Girth of chest at forced expiration, one inch above nipple, 33 inches; at full inspiration 36 1-2 inches. When at rest the comparative measurements of the two halves of the chest showed the left to be 1-2 inch the greater. Expansion of right chest 1 1-4 inches, in striking contrast with the left which was 2 1-4 inches. Girth at ensiform 30 inches.

The area of dulness over the right lung was but slightly, if at all, changed, from that previously observed; yet the degree of impairment of the

note was less marked than at the time of rupture. Breath sounds over the base of the right lung were still increased and were accompanied by both fine and coarse rales. In the anterior axillary line at the seventh rib a to-and-fro murmur was heard. The heart sounds were transmitted over entire base of the right lung. Fremitus was increased over the right apex, and pressure over the epigastrium caused pain in the region of the liver.

Pain in the form of a girdle, encircling the base of the chest at a point anteriorly one inch below the ensiform cartilage, and laterally on a level with the eighth rib, was a prominent and distressing feature, both before and for 2 days after rupture occurred. As the patient expressed it "it felt as a tight belt," the greatest distress being between the anterior axillary and mammary lines on each side. Deep inspiration caused a lancinating pain arising at the epigastrium and radiating to the back. Inspiration also increased the girdle pain, as did paroxysmal coughing. Pressure over the left lobe of the liver, not only elicited tenderness, but was capable of intensifying the pain.

Cough, which was at times paroxysmal, was distressing, but could be allayed by the administration of codeine sulphate and heroin hydrochlorate. It was productive in character and always accompanied by a free, gelatinous expectoration, which was of a grayish color, streaked with blood, and contained many small flake-like particles. Portions of sputum appeared as though dotted with small droplets of dark reddish fluid and this appearance persisted for weeks after rupture (when the sputum was not blood-streaked). A quantity of sputum placed in a porcelain dish and allowed to stand for a time displayed a peculiar marginal halo which was of a chocolate color. The sputum showed no tendency to liquefy, and when placed in a bottle, so as to occupy about one-fourth of its capacity, and the bottle turned from side to side, the sputum was seen to change its position en masse, at the same time clinging to the side of the bottle. The odor was rather sweetish.

Microscopically the sputum contained amebæ coli which were freely motile, and occasionally an ameba was seen enveloping a red bloodcell. Many epithelial cells were present and the flake-like particles referred to often contained cells which at times appeared in the form of radiating columns, were pale, almost hyaline, and without nuclei. A few of these cells were seen to change to a blue color when treated with iodine. Many oil globules were present and the blood-streaked portions showed bloodcells, and some granular material which resembled blood pigment. It was practically free from bacteria, yet stained specimens at times showed a few diplococci; but after examination of the secretions of the throat and mouth, many organisms were found, which were apparently identical with those in the sputum. I am inclined, therefore, to regard these cocci as originating from the throat or respiratory tract. Three weeks after rupture of the abscess into the lung, the sputum contained large quantities of elastic tissue in addition to the other elements above mentioned as present, but few amebæ were present, and these were not freely active. No tubercle bacilli could be found. A series of feeding experiments have been instituted, and two cats employed for this purpose have both developed dysentery. In the stool from both of these animals amebæ have been found.

Examination of the blood gave hemoglobin, 88%; red cells, 4,980,000; white cells, 8,600. Stained specimens appeared to be normal.

Councilman and Lafleur¹ have reported five cases in which amebic abscess of the liver has ruptured into the lung, and one of their cases showed a leukocytosis of 53,000. These authors found the sputum to contain liver tissue, elastic fibers and the ameba coli in four of their cases.

Herewith is cited from the literature, credited to the following named authors, 2,430 autopsies on persons dead of amebic dysentery, in 486, or 20 per cent., of which abscess of the liver was found.

	Autopsies.	Abscess of Liver.
Ballinger (2)	35	4
Annesley (3)	51	26
W. Warring (4)	250	69
Chuckerbutty (5)	30	3
Catteloup (6)	240	47
Mouret (7)	761	133
Eyre (8)	118	27
Ranking (9)	140	41
Moore (10)	404	90
MacPherson (11)	203	40
	<hr/> 2430	<hr/> 486

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Amebic Dysentery.

BY WILLIAM OSLER, M. D.

As, with the exception of the studies of Kartulis, the most important work on the subject of amebic dysentery has come from the Johns Hopkins Hospital, we have naturally followed the recent investigation on dysentery with great interest. I cannot here go into historical

details, but the work in this country dates from March, 1890, when I found amebæ in the liver abscess of a young doctor from Panama. Ever since, the question of the relationship of the amebæ to dysentery has been one of constant study. In quick succession a series of cases occurred in my wards, and were made the subject of study by Councilman and Lafleur, whose monograph has done much to make this form of the disease widely known.

I do not propose in this discussion to speak of the pathology of the disease or of the characters of the amebæ. What I wish to make is a brief statement as to the colitis, with which in Baltimore we have found the amebæ associated.

A sporadic affection, it has not occurred in wide-spread epidemics, either throughout the city or State, so far as I know, or in institutions. A very limited number of cases have been admitted to the wards, only ninety-three to date. In a few instances three, four and five cases have come from the same locality, or three and four members of the same family have been attacked. It has involved chiefly males; only eleven females in our group. It is more common among whites than among the colored; there were only nine colored patients. It is a disease of adults; more than 50 per cent. of the cases were in the third and fourth decades.

While the disease may run an acute course and may prove fatal within a few weeks, in a very large proportion of the cases it is chronic, characterized by slight fever and frequent movements, containing mucus, blood, pus and amebæ. Many cases are from the very outset subacute; a majority of them become chronic, so that the disease drags on for many months or years, with alternating periods of constipation and diarrhea. Very few cases die of the dysentery *per se*; of the ninety-three patients in my wards, only two died of the asthenia induced by the dysentery itself. Two died of perforation.

By far the most important and serious feature of the type of colitis with which the amebæ are associated is the liability to abscess of the liver. Of the ninety-three cases referred to, twenty-three had abscess of the liver. This large percentage is due to the fact that only the more severe cases come to hospital. In Strong's seventy-nine post mortems on cases of amebic dysentery there were fourteen instances of liver abscess.

While at first, after the work of Shiga and Flexner, there was a feeling that possibly all the forms of dysentery might be due to the bacilli, gradually those who have had the most favorable opportunities for studying the diseases have come to the conclusion that the amebic form of dysentery has well marked and characteristic differences. As Dr. Strong has pointed out in his admirable studies in Manila, where the

two forms occur together, the cases can be recognized from each other and readily differentiated. In the first place the amebic variety does not seem to occur in such wide-spread epidemics. Secondly, it rarely has the very acute course, and it kills much more frequently by its complications than by the actual colitis. The chronicity and the liability to recurrence give it a very peculiar stamp. Thirdly, characteristic amebæ are found in the stools or in the liver abscess which may have followed a protracted case. Lastly, and this is a very important point in the differentiation, the serum reaction with Shiga's bacillus is absent in the amebic form. Upon this point we can speak very positively. Since the return of Dr. Flexner from the Philippines there have been some fifteen or sixteen cases of amebic dysentery in my wards, in none of which has the serum reaction, so characteristic of the bacillary form, been present.

Bacillary Dysentery.

BY SIMON FLEXNER, M. D.

It has not been very long since the subject of dysentery was one of the most complex of medical subjects. The search, however, for causative micro-organisms has brought order into the chaos of dysentery. I should like to ask your attention, before speaking of bacillary dysentery, to some of the facts relating to the types of dysentery as ordinarily conceived. Heretofore, it has been the custom to separate dysentery into a variety of clinical types and a variety of pathological types, depending, upon the one hand, on the symptoms attending these types, and upon the other, on the complications found at autopsy upon fatal cases. Of course, it is perfectly well recognized that it is unsatisfactory and inconclusive to have a classification that is based, upon the one hand, on symptomatology alone and on pathological anatomy, upon the other. Our experience in the last twenty or twenty-five years has taught us that the only reliable classification is an etiological one, and that there may be similarity and differences in attacks, and symptoms depending upon like or unlike causes; but, about that we can say nothing. Our past experience shows that tuberculosis with its many clinical types and its many pathological lesions is due to a single specific micro-organism. The pathological types of dysentery, as ordinarily conceived, consist of (1) a catarrhal form; (2) a diphtheritic form, that is, an acute disease of the intestines in which there is a false membrane in the larger intestine especially, and sometimes in both the large and the small; (3) an acute

ulcerative form, usually associated, although not invariably, with the diphtheritic inflammation of the intestine, and (4) a chronic ulcerative form. This chronic ulcerative form is also sometimes associated with the acute diphtheritic inflammation of the intestine and sometimes it is independent of any such affection of the intestine. This represents about the group of lesions as seen pathologically.

When we take into account the varying conditions under which these various pathological types of the disease appear, it would seem that there can be nothing that is at all likely to be specific in the catarrhal form of the disease. We know that it appears in the course of many acute diseases in which the intestine is especially concerned, as for example, typhoid fever and tuberculosis; that it occurs commonly in the course of certain infectious diseases such as scarlet fever, measles and diphtheria in children, and sometimes also in adults. It does not seem at all likely that this catarrhal form, partially associated with secretion of mucus, partially associated with hyperplasia of the lymphatic glands, can have a specific etiology. On the other hand, the diphtheritic and various ulcerative forms are quite different. They are diseases themselves apparently. Though they do sometimes occur in association with other diseases, it would seem as if such occurrences were merely incidental, and that they behave, as a rule, as diseases that have an independent origin. The study of dysenteries with respect to their cause would tend to support this view.

There is another classification of the disease that is sometimes made depending upon its virulence. We hear sometimes of endemic dysentery; again, of epidemic dysentery; and this classification of the disease would lead one sometimes to suppose that each was an independent disease. We are told, for instance, that dysentery is endemic in the Tropics; that it occurs in the Temperate Zone in sporadic or epidemic form. When we stop to compare the lesions which the endemic dysenteries and the epidemic dysenteries have, and notice those lesions found in dysenteries generally, we find that they are really not different. The so-called dysentery of the Tropics is divisible into the two forms:—the acute stage of the affection and the chronic form with ulceration. On the other hand, the epidemic dysenteries are, in their symptoms, not acute. Dysenteries that are invariably associated with the presence of a false membrane in the intestine will appear also ulcerative in character; but ulcers may be associated with the acute lesion as well as in the dysenteries that have been pronounced for a long time. We can, therefore, separate these so-called pathological types.

The last few years have brought into the study of dysentery the use of modern methods of investigation: The microscope and the

culture tube; and there has grown out of this investigation what would appear to be a very satisfactory solution of the vexed dysentery question. If we exclude the catarrhal form of the disease, which has a wide distribution, it would appear as though we could separate this great disease into two distinct classes: A class in which the lesions are acute for the most part, but in which chronic lesions may occur and even become ulcerative in character, and the class in which the acute lesions are more insidious and which come to our attention when they have been of long duration and are presenting themselves as chronic ulcerative forms of dysentery.

The acute form of the disease is associated with the appearance in the intestines and in the dejecta of a microscopic organism that normally is not present in the intestine. Although there has been thorough search for it when the disease has occurred endemically, epidemically and sporadically, it has never yet been found in the normal intestine. The bacillus has well-marked characteristics and belongs to the colon-typhoid group of bacilli. It has, however, characteristics that separate it from the colon bacillus, on the one hand, and the typhoid bacillus, on the other. It can be easily separated from these. What gives it special importance is that when it is present in the intestine, as it always seems to be in this form of the affection, the blood of the subject of the disease develops those peculiar changes, seen also in typhoid fever, that cause agglutination of the bacilli. Studies on animals that can be subjected to various infections have proved that this reaction of agglutination indicates an infection that only occurs after the organism has gained entrance into the body and set up a pathological process, which is to be defined as an infection by that organism, in consequence of which the blood has undergone certain changes that produce this curious clumping. We have come to rely so much on that feature that it seems quite safe to say that, when such a series of phenomena present themselves, it can be presumed that a person presenting these has been the subject of infection. The bacillus which has been found is different from the organism in that form of dysentery in which amebæ with pseudopods are seen. It is more difficult to find the bacillus in the chronic form, in which ulcers are present. This organism has been proved to agglutinate with the blood. There is a vast amount of evidence on this point. It was only three or four years ago that the organism was first described. In Japan, than which there is no more favorable country for the study of the subject, Shiga undertook to study the bacteriological flora of the intestines of persons suffering from dysentery. The difficulty had been that there were too many micro-organisms in the intestines under these conditions. There seemed to be no good rule

for selecting one or the other as the cause of the disease, but he hit upon the idea of using this agglutination reaction, believing it would enable him to pick out of this mass of organisms the particular one concerned in producing the pathological process. He succeeded by this means in separating the organism that was distinct from all the normal intestinal inhabitants and which had properties peculiar to itself, as I have mentioned. About three years ago another opportunity was afforded for similar study in connection with dysentery in the Philippine Islands. It was found there, following the methods used by Shiga, that an organism could be separated from the stools that agreed with the organism of Shiga. In another epidemic Kruse studied cases in Germany and succeeded also in obtaining an organism that cannot be distinguished from the other two. A little while after that, an opportunity was had of studying one of the more chronic forms of dysentery acquired in Porto Rico. I had an opportunity of studying this case, which was under Dr. Musser's care, and was in the person of a returned soldier. The same organism was obtained, and there was conclusive evidence that this new bacillus gave the peculiar reaction of the blood found in persons suffering from the disease.

Its presence has been found, therefore, in Japan, in the Philippine Islands, in Germany and in Porto Rico. We have in this country dysentery sometimes occurring epidemically, sometimes occurring only in the sporadic form. This last summer opportunity was offered for the study of sporadic and epidemic cases. There was the sporadic disease in Philadelphia and the epidemic form in New Haven. It was found that this disease was of the acute type and was associated with the presence of this bacillus in large numbers in the dejecta and in the intestines, when they could be examined in cases that resulted fatally. It presented all the properties such as were known.

This form of dysentery, which is associated with the bacillus, is particularly the diphtheritic form, that is, in the cases in which the organism is present in large numbers. But, when the disease has become chronic and when ulcers are present, the organism is found with great difficulty. It is interesting to know that as the organism is reduced in numbers, the peculiar reaction of the blood disappears. The reaction is much less marked than when the disease is acute. There are stages of the chronic cases in which the reaction cannot be obtained at all.

After all these cases are separated, there still remains a group of cases in which the organism has never been found and in which the blood reaction is not present. These are the cases in which an acute onset has not been noticed. Moreover, if the dejecta of these two

groups of cases be examined microscopically, it will be found that the acute group never give any micro-organisms which are not bacteria; that is, you do not find the ameba. In the more chronic cases in which the blood reaction is absent, the amebæ are present. The group of cases to which the name bacillary dysentery is given, is much less likely to be associated with secondary phenomena. Abscess of the liver is not common and the disease tends to be confined to the intestines. In the intestine it is a very severe form of infection. It sets up a diphtheritic inflammation, but the real damage goes much deeper than the mucous membrane, the muscularis and the serosa being involved. The ulceration may be superficial or deep.

If we compare the pathological anatomy of the ulcerative form of bacillary dysentery with the ulcerations in the amebic form, they are different and distinct. On the one hand, the ulcerations begin in the mucosa and extend regularly into the deeper coats. On the other hand, the ulcers give the appearance of starting in the sub-mucosa, giving rise to a curious serpiginous appearance of the ulcerated gut.

This is about the state of the case of the so-called bacillary dysentery. The separation of this group of cases depends upon definite symptoms and agglutination phenomena. There is the presence of a micro-organism distinct from other organisms, which produces changes in the blood which can be found regularly in the disease. It is a micro-organism which is pathogenic in its properties, as tested upon lower animals; but inasmuch as dysentery, as we know the disease, does not occur in lower animals, it is not surprising that we cannot set up in animals a dysentery acquired from this bacillus. It is possible by using some laboratory animals to cause their death. If the bacillus be introduced into the peritoneum, under the skin or into the stomach, the animals may die, but the organism does not produce dysentery. You produce infection of the animal, to which it succumbs. In rare cases we have succeeded in producing lesions of the intestine (after there have been continuous injections), associated with ulcers of the mucous membrane and with false membrane; but this is a rather poor imitation of the dysenteries as they occur in man. You can do the same thing with a whole host of micro-organisms, the toxic products of which tend to be absorbed by the mucosa of the intestines and produce a toxemia, but not a dysentery.

An especially interesting point is that it has been known for a long time that persons who are the subjects of advanced Bright's disease and advanced cirrhosis of the liver tend, not infrequently, to die in consequence of terminal dysentery. Therefore, it is interesting to inquire as to the cause of that form of dysentery. During the past

summer I had an opportunity to study these terminal dysenteries at Blockley, and it was found that the same micro-organism was concerned in their production. This goes to show that the micro-organism of dysentery has a very wide distribution; that we probably all get it as we do typhoid fever bacilli; but that we do not all succumb to it. People who have chronic diseases are to be regarded as more susceptible than others; and therefore, die of dysentery because this organism has a better opportunity of producing its results.

The Treatment of Dysentery.

By H. A. HARE, M. D.

In the treatment of all forms of dysentery, limiting the use of this term to the conditions which have been described here to-night, there can be no doubt that early instituted measures very materially influence the progress of the disease; or, in other words, if the malady is permitted to continue for any length of time without active medicinal interference, it becomes exceedingly difficult to cure because such pathological changes have taken place in the tissues of the intestine that not only must the results of these changes and the micro-organisms which produce them be removed or destroyed, but in addition a considerable period of time must elapse before healthy tissues can be developed which will result in the performance of normal intestinal functions. So far as diet is concerned it is self-evident that all foods should consist in those substances which are readily digested and absorbed from the stomach and the duodenum in order that as small a residue as possible may pass on downward into the large bowel, where, by its presence, it may produce mechanical injury to the tissues with which it comes in contact, or produce conditions which are favorable to the growth of the various micro-organisms and the development of a still greater degree of inflammation.

In this connection it may not be out of place to point out that milk, which is so universally resorted to in the treatment of all forms of diarrhea, is not always as useful a form of nutriment as it is thought to be; for not uncommonly it will be found that when milk is taken it remains undigested, or forms curds which are indigestible because of the feeble secretion of digestive juice, which curds pass through the bowels and afford pabulum for micro-organisms which, in turn, are injurious to the mucous membrane. If it is given, it should certainly be diluted freely with lime water, barley water or Vichy water,

or else it should be peptonized in order that its digestion may be readily performed, and it is of vital importance in this connection that it should be given in small quantities frequently rather than in large quantities, since its tendency to overload the digestive apparatus in its feeble condition will manifestly produce unfavorable results. Solid food is of course contra-indicated, but semi-solid foods like milk-toast, the digestion of which is aided by pancreatin or taka diastase, and a very soft-boiled egg, will often prove a better diet than one which is more liquid but less nourishing, since the physician, in the presence of dysentery, is faced by two opposing factors: On the one hand, a feeble digestion, and on the other hand, the necessity of supporting vitality to the highest possible point by the administration of proper foodstuffs.

The treatment of the condition itself may be divided into three methods, and each one of these parts finds ardent advocates amongst those of the profession who have had sufficient experience to make us feel that their opinions are of value.

The ipecac plan may be considered among the first of these, and it cannot be doubted that physicians in tropical countries have found it of benefit in so large a number of cases that it is impossible to consider that they have been mistaken in their clinical observation. It will be remembered that its use under these circumstances is almost entirely empirical. So far as we know, any influence which it produces is brought about by reason of the fact that it tends to produce a rather profuse flow of bile in such patients, and the close connection which exists between torpidity of the liver (to use a popular phrase) and congestion of this organ, with congestion of the colon, makes its employment under these circumstances more rational than would appear at first glance. The ipecac is commonly administered in large doses, and vomiting naturally ensues. After vomiting has taken place, small doses of three grains are given every hour and continued until a profuse, black, tarry stool is passed, this stool being considered a most favorable sign, vomiting being controlled by the use of opium, which also relieves tenesmus and pain. It may be necessary in this vigorous plan of treatment to freely employ stimulants, but under these circumstances alcoholic stimulants had best be avoided because of their well known influence upon the liver. It has been thought by some that the opium is largely responsible for the beneficial results that follow this treatment; but, on the other hand, it is a fact that the use of opium alone, while it may temporarily relieve pain and tenesmus, often in the end makes the patient worse, in that it locks up in the bowel micro-organisms and secretions which nature, if left to herself, would endeavor to get rid of by purgation.

The other plan of treatment which is quite worthy of our consideration is the purgative plan, which has come forward so largely in the medical press within the last few years; probably because of increasing experience on the part of American and English surgeons in the Philippines and in South Africa. Here, again, clinical evidence is rapidly accumulating which proves beyond all doubt that in a certain proportion of cases of acute dysentery, the employment of magnesium sulphate combined with aromatic sulphuric acid is a most advantageous method. The bowels are first thoroughly moved with Epsom salts or with Rochelle salts, and then aromatic sulphuric acid is given freely, so that it will exercise its well known astringent or constipating influence. This plan is a more rational one than that which concerns the employment of ipecac, in that it is a well known fact that the micro-organisms which are commonly found in the intestines in dysenteric cases are destroyed or rendered inert by an acid medium, and it has long been known by the profession that the administration of sulphuric acid is apt to produce an acid reaction of the stools, so that its beneficial influence in dysentery does not rest alone upon its astringent effect, but upon its power to destroy the infecting micro-organisms, just as its use in Asiatic cholera meets the double indication of restraining diarrhea and destroying the comma bacillus.

The third plan of treatment consists in the administration of intestinal antiseptics, of which perhaps bismuth salicylate, benzonaphthol, and salol have been most commonly employed. Theoretically, it is easy to conceive that these substances may be advantageous, but practical experience has, we think, shown that they fail to exercise the degree of antiseptic influence with which they are credited, and while they are undoubtedly useful as what might be considered side-tracks of treatment, they are not of sufficient importance to justify their employment to the exclusion of the ipecac or saline methods which have just been described. The employment of calomel and corrosive sublimate in these cases as intestinal antiseptics is often followed by good results, but here again the antiseptic influence probably obtains an amount of credit which it does not deserve; the real value of these substances resting upon the fact that they increase the activity of the liver, both in destroying toxic material and in secreting bile.

In the brief space which is allotted to this paper, this is all that one can say in regard to the internal treatment of dysentery. Without doubt its local treatment by high intestinal irrigations is of very great value. Suppositories do not reach the difficulty. On the other hand, copious clysters which will reach far up into the

descending and transverse colon are necessary. In a number of instances the writer found that injections of zinc sulphocarbolate, in the proportion of twenty grains to the pint, have produced very satisfactory results; the zinc acting both as an astringent and antiseptic. Other practitioners have employed copious injections of weak solutions of silver nitrate of the strength of a dram to three pints, and the tenesmus which is frequently associated with the dysenteric condition, or the introduction of the soft rectal tube, can sometimes be avoided by the use of a ten-grain iodoform suppository half an hour before the injection is to be given. This suppository, by its local anesthetic effect, is of service, and we have thought that the absorption of the iodine from it was also advantageous. When the weather is intensely hot, the patient febrile and the belly tender, an injection of ice water is sometimes advantageous. But it should not be employed unless it is grateful to the patient. While tannic acid in weak solutions has been highly recommended in many cases of cholera, it does not seem that it is particularly advantageous in dysenteric cases.

The method of giving the intestinal lavage is of considerable importance. It should not be given by means of a pumping syringe, but always by means of a fountain syringe or surgical irrigator. The pressure employed should never be greater than two or three feet, and it is much better that the injection should be gently given, so that it takes fifteen or twenty minutes to find its way up into the intestine, than that it should be delivered forcibly enough to produce angry contractions of the bowel, which will cause great agony and so much irritation that the treatment makes the patient worse.

Where great irritability of the bowel exists, it is probably better to employ two rubber catheters side by side, one being for the intake and the other for the outflow, since in this way great distention of the bowel is avoided. In instances in which cold water injections seem inadvisable, very hot water may be employed, but I believe that it is distinctly disadvantageous to employ tepid water, which has a relaxing and enervating effect, and does not possess the healthy stimulant effects of marked cold or high heat. I am also firmly convinced that where pure water is used, it is best to employ normal saline solution, since by this means maceration of the intestinal mucous membrane and ulceration is avoided, and we all know the beneficial influence of normal saline upon the surface of a healing ulcer in distinction from that of the rather harmful influence of pure water upon such a raw surface.

This article is not complete without reference being made to one pathological condition and two forms of treatment which have not been

referred to. The first is that form of dysentery which complicates certain cases of renal disease of an advanced type, and which may perhaps depend upon the bacilli of Shiga. In such instances, of course, active measures should be taken to aid the kidneys in eliminating impurities from the body, since it is possible that the irritation of the colon depends upon the elimination through the bowel of toxic materials which ordinarily escape by the kidneys, or that the lowered vitality of the patient as the result of his renal disease makes him unduly susceptible to dysenteric infection.

A method of treatment which promises much, but which has only recently been tried in that form of dysentery which depends upon Shiga's bacillus, is that which has been written about in such an interesting manner by the late Dr. Eskridge, of the United States Marine-Hospital Service, who has recorded the very excellent results which have followed the employment of antibacterial serum in the treatment of dysentery in Japan, where the disease is not only endemic but epidemic, and where the results which have accrued are surprisingly good. This serum is not in the nature of an antitoxic serum, but an antibacterial serum—that is to say, it does not antagonize toxins made by Shiga's bacillus, but renders the body unsuitable for the growth of this micro-organism.

The other form of treatment to which I have referred is that which is directed to combating amebic dysentery by means of injecting quinine in 1 to 5,000 solution, sufficiently high in the rectum for it to exercise its fatal effect upon the ameba coli. This is a definite specific method of treatment resting upon as rational a basis as the employment of quinine in malaria, and it is to be hoped that with the discovery of the cause of asylum or epidemic dysentery an equally efficient remedy may be discovered which will affect Shiga's bacillus as actively as quinine affects the ameba coli.

DISCUSSION.

DR. J. M. ANDERS said that he had examined the patient whose case was reported by Dr. Boston about 2 months ago and that he found that the local symptoms were somewhat aggravated, particularly the cough and expectoration. The latter was grayish-white in color, very faintly blood-tinged and contained ameba coli. A second examination a month later showed the condition very much improved. The cough was very slight, occurring only in the mornings, and the expectoration was practically nil. There were a few moist rales and elastic fibers were present in the sputum, but there was not a single physical sign pointing to cavity formation. The explanation of the afebrile course of these cases is said to lie in the fact that, as a rule, pus-producing organisms are not present in cases of amebic abscess. A further explanation of the afebrile course in the case just presented is found in the fact that

before the appearance of the symptoms from which the diagnosis of amebic abscess of the lung and liver was made, there was almost total absence of symptoms, although he believes that latent lesions were actually present in the bowel.

Dr. J. H. GIBBON said that in the early fall, he had had an opportunity of operating upon a case of liver abscess of probable amebic origin, although no amebæ had been found in the pus. The patient was a man who had resided for several years in South Africa and had contracted dysentery; although improved when he came to this country he had relapses. Almost a year before appearing at the hospital he developed distention of the upper and right portion of the abdomen which became so marked as to cause elevation of the costal border. A diagnosis of abscess of the liver was made. From the duration of the condition and the absence of amebæ from the stools, Dr. Gibbon was led to believe that the man was suffering from a broken-down hydatid cyst of the liver; although the possibility of abscess was considered. At the operation a large amount of sterile pus was removed. Amebæ were not sought for in scrapings from the abscess wall. The man had made an excellent recovery, in spite of a sinus that had existed for 3 months. He also referred to a case under the charge of Dr. R. H. Harte in which a liver abscess ruptured into the pleura, in which a sinus had existed for nearly 2 years and which finally closed after thorough scraping. A point of interest in the case Dr. Gibbon had operated upon was the entire absence of pain. Although there was great distention of the abdomen, the only discomfort was in respiration. The leukocyte count, which was low, was accounted for by the long duration of the abscess. He referred to a number of cases of amebic dysentery cured by the operation of colostomy and the through and through irrigation. In one case an artificial anus was made so that the bowel might be put completely at rest. In consideration of the safety of colostomy it is thought justifiable to prevent the severe complications, such as abscess of the liver, which end in death.

Dr. JAMES TYSON thought that it would be exceedingly satisfactory to the clinician to learn that the etiological element of the different forms of dysentery had been reduced to a single cause. He had been quite hopeful from what Dr. Flexner had said and from some recent reading that this was about to be realized. After hearing Dr. Osler's paper, however, his hopes had been somewhat disappointed and it seemed to him that 2 distinct forms of dysentery must be recognized from the etiological standpoint. It was, he said, satisfactory "to those of us who are no longer very young" to know that the catarrhal form of dysentery is still allowed to exist as distinct from the other forms, the form of dysentery formerly regarded as largely the result of eating unripe fruit during the months of August and September. The terminal form of dysentery especially associated with Bright's disease he had had opportunity of observing and his experience sustained the views of Dr. Flexner. He regarded it as favored by the lowered vitality following a long course of any chronic disease. He said that he had not used the ipecac treatment, because it is particularly adapted to the tropical dysenteries, with which he had had no experience. He thought that the purgative

method was usually the most promptly efficient. The saline treatment as Dr. Tyson practiced it consisted in dissolving an ounce of magnesium sulphate in a pint of water and giving an ounce of the solution every hour until copious purgation was secured. This was associated with cold enemas, and the use of just sufficient opium to quiet irritation. In the treatment of bacillary dysentery it would seem that this method by securing an eliminative effect might be indicated.

DR. ALFRED STENGEL said that the history of amebic dysentery was curiously full of coincidences. The ameba coli, first described by Laubel, was really discovered by Losch in St. Petersburg. It had happened that the patient was a fisherman, who had been fishing and was supposed to have been drinking the water in one of the surrounding swamps. This ameba was discovered in the mud of the same swamp. At the time Losch wrote his paper upon amebic dysentery, Professor Butts, of Bonn, was conducting his experiments upon the physiological action of quinine, and made those remarkable studies of the effect of quinine upon some of the protozoan organisms, showing that the quinine solution was capable of staying the amebic movements. As a result of his studies he elaborated the theory of the antiphlogistic effect of quinine which is upheld at the present day. Losch, knowing the work of Butts, suggested that solutions of quinine in 1:5000 might be a proper treatment for amebic dysentery. The treatment has been employed to the present day. One of the earliest writers on the subject of amebæ in the intestinal tract, Professor Cunningham, of India, called attention to the fact that amebæ are present in the dejecta of herbivorous animals, in a large proportion of cases, and in human dejecta when those dejecta were rendered alkaline. It was, therefore, suggested that in the presence of amebæ, if the intestinal contents are alkaline the amebæ were able to thrive and multiply. Per contra, if the intestinal contents were rendered acid, the amebæ found an unsuitable soil for multiplication. Magnesium sulphate and sulphuric acid, referred to by Dr. Hare, Dr. Stengel regarded as an old method revived. He had seen it used with good results in a series of cases he had followed in patients under Dr. Pepper's care in 1889 and 1890. The search for some therapeutic means to render the intestinal contents an unsuitable soil for the amebæ had seemed desirable. He, personally, had used the combinations of quinine, silver nitrate and other remedies with more or less success, usually less, and the so-called antitoxins by the blood, also without much success. He cited the case of a gentleman who had amebic dysentery for 4 or 5 years from which he gradually improved and was able to leave the hospital. After this he had suffered a relapse. The treatment instituted, which Dr. Stengel stated was not original with himself, was the administration of sulphur in capsules of 10 grains 3 or 4 times a day, with opium sufficient to modify the laxative effect of the sulphur. The amebæ disappeared from the stools and the movements, which had been liquid for 6 months, became solid within 24 hours. At the same time a brother of the patient in Costa Rica was under the same treatment, and the same result was had in his case.

DR. OSLER said that he had never seen the operation mentioned by Dr. Gibbon performed. He knew of one case in Guy's Hospital in which it had

been done with great benefit. Early in the disease he approves of the use of quinine injections. The efficacy of this method can be beautifully demonstrated by passing the catheter, when hundreds of motile amebæ will be removed, all of them throwing out their pseudopods. An hour later, after irrigation, there may not be a single active ameba after passing the tube. Large numbers may be secured, but all apparently killed by the quinine irrigation just as they could be killed by passing the quinine solution under the top cover on the slide instead of up the bowel. The difficulty in giving the proper irrigation is in getting the patients to bear it. The point made by Dr. Hare that the irrigation should be allowed to run in slowly is important. The patient's hips should be elevated and the patient should be turned from side to side during the irrigation. In the old chronic cases he thinks the quinine irrigations do little good.

DR. FLEXNER said that theoretically serum therapy is of course the most hopeful of all methods of treatment for the bacillary form of the disease; and, a priori, having the organism, there should be no difficulty in producing an effective serum. But the matter is not a simple one. Typhoid fever, dysentery and cases of that class are not toxic diseases primarily, but infectious. In diphtheria there are a few local points in which the organism develops; these points are outside the body or in connection with some cavity. With dysentery and typhoid fever the case is different, in that the micro-organisms are established within the body. The injurious part of the organism is contained within itself. It must be remembered that thus far the production of these serums has been limited to the larger animals. The horse gives an antitoxic serum, but the factors that enter into its production are different from those entering into the production of diphtheria antitoxin. With one there is formed a combination with certain substances present in the blood, and this combination is not easy to effect. It is not even proved that it can ever take place directly, and if, therefore, it ever comes to the point where we can use a serum which is nearer that of human beings than the horse, combination will be much easier. Efforts in this direction are hopeful but the results are not yet perfect.

DR. H. A. HARE said that none of the speakers, except Dr. Tyson, had brought up a point of considerable interest, that is, the definition of exactly what was meant by dysentery. As he understood the discussion, it did not deal with the various forms of diarrhea which follow the ingestion of indigestible substances, but with a condition in which the colon was involved in an inflammatory process, catarrhal or otherwise. Regarding through and through irrigation, Dr. Hare thought surgery rather overreached itself when operating in this way. On the subject of enteroclysis Dr. Hare spoke advisedly because Dr. Martin and himself had made experimental investigations upon it. They found that if the injection was "sneaked" into the bowel, so that the bowel was not angered there was no difficulty, in the majority of instances, in getting medicated fluid as far as the ileocecal valve. When success is not obtained with the two-way catheter, the hydrostatic pressure in which is 6 inches, Dr. Hare felt that failure is due to bad technique. In one case in which injections had been carried out, and in which the bowel had

become irritable and the patient was neurasthenic, Dr. Hare had, with the assistance of a surgeon and ethyl bromide anesthesia, irrigated the colon thoroughly from the ileocecal valve for 21 nights with most happy results. Dr. Hare did not think that anything more unfortunate could happen to a patient than to have an artificial anus as well as a real anus through which to pass liquid stools. Dr. Hare believed that physicians would soon use the sulphur treatment more generally than had been the case during the past few years.

The Diagnosis and Treatment of Calculus of the Lower End of the Ureter in the Male.

BY HUGH H. YOUNG, M. D.

BALTIMORE, MD.

[Read by invitation, March 12.]

In 1898, Fenger,¹ in a classical work on the ureter, said: "There is no difficulty in gaining access to the upper three-fourths of the ureter by the oblique lumbar incision. It is difficult with the lower fourth of the ureter, which is located deep down in the pelvis and is even held by Le Dentu to be inaccessible. But as Cabot has pointed out this portion is also accessible without opening into the peritoneum by means of the sacral operation of Kraske."

But no one has used the Kraske incision, and in December, 1899, Henry Morris,² after an exhaustive study of the literature, was forced to admit that no case had been noted of ureterolithotomy for stone impacted in the lower end of the ureter in the male.

The apparent rarity of such operations has led the writer to consider the following cases worthy of publication:

Case I. CALCULUS IMPACTED IN LEFT URETER FOR PROBABLY 27 YEARS. REMOVAL BY EXTRAPERITONEAL URETEROLITHOTOMY THROUGH AN ILIAC INCISION. CURED.

W. B., aged 29 years, married. On August 28, 1901, consulted me for bladder and kidney trouble.

Past History. Had gonorrhea 11 years ago, a fairly mild attack, but accompanied with epididymitis. He thinks he was completely cured. Has never had any serious illnesses.

Present Illness. Ever since childhood patient has had more or less constant pain in the region of bladder and left kidney. Patient thinks this began when he was about 2 years of age, and has never been entirely free from it during these 27 years. There has generally been a dull aching pain more or less constantly in the region of the bladder, and a sore feeling in the region of the left kidney. At varying intervals of 2 weeks or more he has had attacks of pain of great severity located in the neck of the bladder and radiating from

there along the urethra to the glans. At times the pain is also severe in the left lumbar region. There has never been any retraction of the testicles. These attacks often come on suddenly and last for 2 or 3 days, they are always accompanied by hematuria and never by frequency of urination.

The attacks as outlined above have continued up to the present time. He has now a dull aching pain in the region of his bladder, and the soreness extends up to the left kidney. These symptoms are sufficient to give him considerable discomfort all the time. He has no sharp attacks of ureteral colic, and micturition is apparently perfectly normal.

Examination. Patient is a well-nourished man. Lips of good color, heart and lungs negative. Abdominal examination negative, no tenderness in the region of the left kidney nor along the ureter. Genitalia normal, no urethral discharge, urine clear, no shreds, very acid in reaction, microscopically negative. Prostate per rectum somewhat enlarged, there is a nodule in the region of the ejaculatory duct, nothing abnormal felt above the prostate, and no tenderness.

September 3, 1901. Urine to-day is slightly reddish in color, and under microscope red bloodcorpuscles are found.

September 4. Cystoscopic examination. Catheterization of the ureters, discovery of a stricture of the left ureter.

The mucous membrane was everywhere normal except in the region of the left ureter. The end of the left ureter was located in a considerable ridge which ran in the direction of the ureter down into the trigone. The ridge was much larger than normal and just to the outside of the mouth of the ureter, which was round in shape and much smaller than normal, there was a deep depression in this ridge. To the outside and back of this the ureteral ridge projected far into the bladder almost as a septum, on each side of which was a fairly deep pouch around which the bladder wall was considerably trabeculated. The mucosa along this ridge and especially in the region of the ureter was very red in color, and much rougher than normal. The right ureter and region around it was normal in appearance. The Casper ureteral cystoscope was then introduced and the catheter inserted into the mouth of the left ureter. Almost immediately the mucous membrane of the ureteral opening became invaginated, and seemed to be drawn along by the catheter which would only pass for a short distance (1 or 2 cm.). Several attempts were made to introduce the catheter farther, but without success, and no urine was obtained from it. The conclusions reached in regard to the left ureter were as follows; the lower end was strictured. The ureter just above it (the intramural portion) was much dilated producing the bulging of the bladder wall over it, in which a stone probably lay.

The right ureter was normal in appearance and the catheter entered easily, but would only proceed for a distance of about an inch and a half, when the same invagination occurred (probably owing to a lesser congenital narrowing). A small amount of urine was obtained from this ureter, and showed nothing abnormal except a few red corpuscles, which were thought to be due to traumatism.

September 15, 1901. X-ray photograph taken by Dr. Deetjen, shows a

distinct shadow of a calculus in the region of the left ureter, at about its junction with the bladder. The shadow is 2 cm. long by 1-1.2 cm. wide, and oval in shape. It is seen just to the side of the shadow of the coccyx, about 2 cm. from the median line of the pelvis, and 3 cm. from the shadow of the ischium, and about 4 cm. in front of the shadow of the posterior wall of the pelvis. There is no other stone to be seen.

Another plate taken higher up shows a larger shadow of the left kidney than for the right, but no calculus.

X-ray photograph taken by Dr. Sampson, of the Johns Hopkins Hospital, shows a calculus of the same size, and in the same location in the pelvis, as described above. The shadow here is seen about 3 cm. to the outside of the median line opposite to the tip of the coccyx.

October 15, 1901. Patient has been under observation for 6 weeks. During this time he has had an almost constant dull aching pain in the left kidney, and a pain of a little greater severity which he says is deep-seated and apparently located back of the symphysis pubis, and from there at times extends along the neck of the bladder to the end of the penis. Micturition has no effect upon these pains, and is of normal frequency. During this time blood was at times present and at others absent. On September 13, the hematuria was considerable. When free from blood the urine contained no albumin.

October 16, 1901. *Operation. Young. Ether. Extraperitoneal ureterolithotomy. Extraction of a stone from the justavesical portion of the ureter. Stone pushed upward and the ureter incised at the pelvic brim. Ureteral wound closed.*

The abdominal incision, 7 inches long, was made from a point about the middle of Poupart's ligament, upward and outward, and passing about an inch from the spine of the ilium. As soon as the peritoneum was reached this was separated from the outside of the abdominal wound by means of the fingers, and the stripping process carried rapidly downward over the iliacus and psoas magnus muscles and the iliac vessels easily exposed. Search was then made for the ureter, bearing in mind the fact that it was generally to be found adherent to the elevated peritoneum. The peritoneum was found very much thickened, and the tissues greatly changed by fibrous hyperplasia. Nothing simulating the normal ureter could be found, and in the place where it should be a large thickened coil, which seemed to be about the size of a small intestine, was found. On account of its great size and because it seemed to be intraperitoneal, this was not supposed to be the ureter, until, after the wound had been carried upward and outward exposing the kidney. The pelvis was found greatly dilated, and coming from it, a very greatly dilated ureter was found, which was before supposed to be the intestine. This ureter was about one inch in diameter and considerably convoluted. It was separated from the peritoneum beginning at the pelvic brim by dissection and continued by the finger to the junction with the bladder, at which point a stone was felt, and after some little pressure against its deepest end with the finger, it was dislodged, and gradually pushed upward in the ureter until it reached a point about 5 inches from its lower end. Drawing the ureter taut around it and using the stone as a bobbin, two mattress sutures of fine silk were placed

in the ureter over the stone. An incision was then made and the stone removed. It proved to be a calculus 2 cm. long, 1 1-2 cm. wide, and 1 1-4 thick. It was very hard, and generally smooth, and showed broad grooves which had been worn away by the urine. The stone is apparently composed of alternating layers of urates and oxalates. After removing the stone from the ureter a metal probe was inserted and search was made for other stones upward and downward in the ureter, but none were found. Attempt was then made to pass probes, catheters and the ureteral dilating instrument devised by Dr. Kelly through the lower end of the ureter into the bladder, but without success.

The points of small instruments apparently engaged in its lower end, but would not pass into the bladder. Remembering the fact that it was impossible to pass a ureteral catheter for more than a short distance into the ureter during the previous cystoscopic examination it was decided to make an opening into the bladder, and then dilate or incise the stricture from the bladder. Another reason for dilating this stricture was that it was found impossible by squeezing and milking the ureter to force the urine with which the part below the incision was distended, into the bladder and thus empty it. It was thought best to make the incision into the bladder along its left side, rather than to make a new suprapubic opening through the abdomen. In order to do this it was necessary to dissect the vas deferens from the bladder, and to push it downward so as to make an incision above it, into the bladder.

After the opening had been made, the fluid evacuated and the bladder dried, several attempts were made to pass a probe into the ureter from below, but it was found impossible to go more than 1 cm. Working with the small bulbous dilator (of Kelly) through the ureter from above, and with a finger making counterpressure in the bladder covering the end of the ureter it was finally possible to push the small end of the dilator through the stricture, until it appeared in the bladder. Palpation with the finger then showed a distinct hard ring about 1 cm. distant from the orifice of the ureter, and completely encircling its calibre, and of such strength as to prevent one from pushing the bulbous part of the dilator through. The caliber of the stricture was apparently about 3 mm, and the thickness of the ring about 4 mm. The very smallest Kelly dilator was next tried, but with the same result, i. e. the instrument would pass until the bulbous enlargement came against the stricture, and its point appeared in the bladder, but would go no farther. *It was then decided to divide the stricture with a knife, and an incision was accordingly made along the dilator through the mucous membrane of the bladder into the stricture, until it was divided, and the instrument could pass freely into the bladder.* The incision required was probably 1 cm. long, and had to be made by the sensation of touch, keeping the knife against the ureter dilator. The larger dilators and catheter were then easily passed into the bladder through the ureter from above. The incision in the bladder was closed by 8 mattress sutures of fine silk, the edges of the wound being inverted. The ureter was also closed with 3 mattress sutures of fine silk. A small gauze drain was placed running down to the bladder and also one to the wound in the ureter and brought out through the middle of the abdominal

wound. The muscles and fasciæ were closed with mattress sutures of silver wire, and the skin closed with subcutaneous silver.

November 6, 1901. Patient's condition excellent since operation. The urine which was at first bloody is now almost clear. The wound was dressed to-day and a portion of the gauze drain removed, and the subcutaneous silver sutures taken out of the sutured wound. Wound healing per primam.

November 13. The remainder of the drain was removed, there has been no suppuration, and at no time any leakage of urine from either the ureteral or vesical wounds.

November 21. Abdominal wound has healed completely, patient is in excellent condition. Discharged from hospital. He is apparently perfectly relieved.

March 7, 1902. Patient says that he has been in splendid health, has had no pain at all in the region of the bladder, ureter or kidney, and urination is of normal frequency; his urine has been perfectly clear, and he has gained about 20 pounds in weight. Left kidney and ureter not palpable nor tender. On rectal examination a small mass is felt above the left seminal vesicle (probably the cicatrix of the ureteral operation). Prostate still somewhat indurated. Urine is perfectly clear, and normal.

Cystoscopic Examination. Bladder healthy, right ureter apparently normal, and functioning frequently. The left ureteral orifice is in the shape of a crescent with concavity about 3 times as long as normal. At the outer end of the crescent a small aperture is to be seen through which the urine comes. The usual peristaltic wave is not seen but a fairly forcible jet of urine separates the edges of the outer part of the orifice. In the inner two-thirds the lips of the orifice are approximated and are not separated by the outflowing urine. The cystotomy wound in the left side of the bladder cannot be seen.

Case II. CALCULUS IMPACTED IN THE INTRAVESICAL ORIFICE OF THE LEFT URETER, DETECTED BY THE CYSTOSCOPE AND EXTRACTED BY MEANS OF A URETER CATHETER.

S. B., aged 31 years, male. Admitted to the Johns Hopkins Hospital July 8, 1901.

Complaint: Kidney trouble.

Family History. Patient's mother is supposed to have died of stone in the bladder.

Past History. About 7 years ago the patient, in good health at the time, was suddenly seized by a severe pain in the region of the left kidney. This lasted about an hour and was relieved by morphine. There were no other symptoms during this attack that the patient noticed. Six months later sudden and severe pains attacked the patient in the left kidney, accompanied by vesical tenesmus, painful and frequent micturition, the desire not being relieved by passage of water, and pain along the urethra, often definitely felt at the end of the penis. These symptoms persisted about a week with more or less severity and then gradually disappeared. Since then patient has had no decided attack, though at irregular intervals he was troubled by slight pain and discomfort in the left kidney.

Present Illness. During the first week in April, the patient was seized by a severe pain in the left kidney, which continued for several hours and was only relieved by morphine. This was unaccompanied by other symptoms, but 2 days later the patient felt the pain about the neck of the bladder, and had constant desire to micturate, the act giving him no relief. He also suffered from severe pain at the end of the penis. At times he urinated freely, but at others something seemed to keep the water from coming. Crises of pain usually occurred twice in the 24 hours. These symptoms have continued up to the present time, though the kidney pain has lessened while that about the neck of the bladder has increased, and he now has an almost constant pain in the end of the penis, and twice during the day he has had a colicky pain in the left side.

Examination. Patient strong, well-nourished man, heart and lungs negative. Abdomen held tense, rendering palpation difficult. Liver, spleen and kidneys are palpable. Genitalia: Left testicle is markedly retracted (of recent occurrence). Penis normal, but meatus quite small. Rectal examination: Prostate little enlarged, there is distinct tenderness chiefly up in the median line, pressure causing great pain and slight induration is felt at the tender point. A searcher passed into bladder detected no definite stone, but a slight grating sensation was present. (This was followed by chill and pyrexia of 105°.)

On admission, the patient's urine was acid, 1018, no sugar, trace of albumin, white and red bloodcorpuscles, calcium oxalate crystals, no bacteria seen.

July 9, 1901. A meatotomy was done to allow more room for a subsequent cystoscopic examination.

July 10, 1901. *Cystoscopic examination. Detection of small calculus impacted in left ureteral orifice. Calculus dislodged by instrumentation with ureteral catheter and Cusper's cystoscope.*

The patient was prepared for an aseptic examination, and after careful irrigation of the bladder the Nitze cystoscope was introduced. The bladder was found to be normal everywhere. The prostate showed no intravesical hypertrophy. The right ureter was normal in appearance, functionated regularly, and the urine ejected was clear. In the region of the left ureteral mouth a small irregular mass projected into the bladder cavity. At first it looked like a mass of fibrin, but after repeated washings of the bladder it was seen to be a dark, irregular calculus, which was caught in the mouth of the ureter. The surface of the calculus was very irregular and several small, sharp processes were seen. The stone was 4 or 5 times as large in diameter as the end of the ureteral catheter though it was not spherical in form. It did not completely fill the ureteral orifice, for to one side there was a patency through which a fine stream of urine was ejected.

The ureteral ridge was considerably enlarged, apparently indicating that the ureter above was dilated. An attempt was now made to pass a ureteral catheter into the small opening left by incomplete blocking of the calculus of the ureteral orifice, but in so doing the stone was pushed back into the ureter for a short distance, leaving a round, patulous ureteral orifice with

thickened edges. On withdrawing the catheter the stone followed it and again presented itself at the ureteral orifice, but there lodged. It was now decided to attempt to dislodge the stone by lateral pressure with the end of the catheter, i. e. to prize it out of the ureter if possible. The prism of the catheterizing cystoscope was therefore placed nearer the stone and the catheter made to lie in a direction at right angles to that of the ureter and with the tip of the catheter against the side of the calculus. Pressure was then made against the calculus by pushing the catheter, but the former was held so tight in the ureteral orifice that it only swayed to and fro under the force exerted on it, but was not dislodged. *After several exciting attempts, strong lateral pressure was obtained closer to its point of detention, and the calculus was finally prized out of the ureter and fell to the floor of the bladder, leaving a large round hole—the dilated ureteral orifice.* This manœuvre caused considerable hemorrhage from the ureter and the prostate, so clouding the fluid in the bladder that the cystoscope failed to locate the stone in the bladder. Bigelow's evacuator was now used, without success, and the patient was returned to the ward, and instructions given to preserve and filter all the urine he passed. Patient says that he was immediately relieved of the pain which he had suffered, by the cystoscopic instrumentation, and has had none since. A slight chill and rise of temperature followed instrumentation.



CASE II. Cystoscopic extraction of intravesical ureteral calculus.

July 11, 1901. This morning, about 40 hours after cystoscopic examination, the calculus was passed during urination. The calculus is of a dark brownish-black color and about 6 mm. in diameter and 3 mm. thick, the

surface is rough with sharp irregular processes and spicules. There was no pain produced by its passage through the urethra and the patient was not aware that it had escaped until it was found in urine voided. The patient says that he has had no return of pain in bladder, penis or kidney since the cystoscopy.

July 12. Patient has for 5 days suffered with a pyrexia, which began with a chill following searching the bladder for calculus 2 days before cystoscopy. To-day a definite epididymitis is present. There is no pain in bladder or kidney.

July 17. Patient is still free from pain, except that in the epididymis, which is now very slight. The urine is slightly cloudy and contains cocci and bacilli, but no red bloodcorpuscles.

Cystoscopic examination shows a slight acute cystitis. The orifice of the left ureter is still large and gaping, but smaller than before. No stone is present. Patient discharged.

March, 1901. Patient returns for examination, says he has had no return of renal colic. Examination with cystoscope shows the left ureter much smaller than when last seen. No calculus present.

CASE III. CALCULUS IMPACTED IN THE RIGHT URETER ABOUT ONE CM. ABOVE ITS END, DEMONSTRATION WITH URETER CATHETER AND RADIOGRAPH. COMPLETE DISAPPEARANCE AFTER WATER CURE.

J. E. L., aged 34 years, admitted July 13, 1901, to Dr. Osler's service in the Johns Hopkins Hospital.

Complaint: Pain in back and side.

Past History. Patient had typhoid fever 4 years ago, rather light attack, malaria following the fever. While the patient was still in bed both legs became swollen and edematous, accompanied by a slight pain in each groin. Swelling gradually disappeared, and there has been no trouble since then. Has had malaria frequently. The last attack being 10 months ago. Has never had gonorrhea. Had never seen any blood in his urine nor had an attack like present one before.

Present Illness. On Sunday, June 30, 1901, patient drove 36 miles in a carriage. Midway the patient voided urine and noticed it was very dark colored. For a week previous he had had a languid feeling, but no definite pain, had had no chills or fever for 10 months. The urine continued to be dark colored and the following day it was very scanty and contained considerable blood.

On Tuesday afternoon went to a physician, who found that he had a little fever, and made diagnosis of malarial hematuria and prescribed calomel and quinine. Before taking the medicine, however, on Tuesday night the patient had a violent attack of pain in the right lumbar region, associated with violent retraction of both testicles and severe pain in both of them. There was no pain in the left side at this time. During this time patient was voiding his urine at long intervals, and very little in amount, had no pain in the bladder. Soon after the severe pain came on he was seen by his physician who gave him morphine, 2 large doses hypodermically, before he was relieved.

After that patient slept for a while, but when he awaked he again suffered very severe pain in the right lumbar region, as before.

During the following day patient had a dull pain in his right side, but in the evening another severe attack of pain in the same location came on, which again required morphine. During this time the urine became gradually less bloody. Patient then decided to come to the Johns Hopkins Hospital. On the night of July 3, patient had another severe attack on the boat coming up Chesapeake Bay, and when admitted to the Hospital on the morning of July 4, he was still suffering with a slight pain in his side.

Status Presens. Patient has more or less pain all the time. Urination is scanty and the pains when severe require morphine and never cease suddenly. Urination infrequent, unaccompanied by pain. Urine contains blood, no clots, stones, nor gravel noticed at any time.

On July 4, patient had another severe attack of pain and was given morphine and put in a hot bath. This was the last severe attack of pain patient had during stay in hospital. The patient's greatest pain was always above the point of the top of the hip bone, behind, and was always accompanied by retraction of both testicles, the right being more violently retracted.

Examination. Patient is poorly nourished, mucous membranes a trifle pale, complexion sallow, heart and lungs negative. On bimanual palpation there is an impression that the lower portion of the right kidney descends between the hands, and some pain is complained of on pressure with the posterior hand. Rectal examination: Prostate and vesicles normal. Pressure on bladder elicits some tenderness. Examination of blood for malarial organisms negative.

July 12. The patient has had, since admission, no attacks of acute colicky pain, though there has been some dull pain in the right lumbar region. Two X-ray photographs were taken by Dr. Sampson, each showing the presence of a shadow (probably stone) about the lower portion of the right ureter. The shadow is about 4 by 6 mm. in size, and is seen in about the same position as in Case I. It is 6 cm. directly in front of the sacro-iliac synchondrosis, and about 5 cm. from the median line of the sacrum, and opposite its lower end.

The ureters were catheterized on July 13. *Cystoscopic examination* showed bladder and ureteral orifices to be normal in appearance, the left ureter was catheterized with ease, the catheter passing well up toward the kidney. On the right side the catheter passed only for a distance about 2 cm., when it met with a definite obstruction, but it was only after considerable pressure and manipulation that it was possible to pass by it. The catheter was, however, then passed upward toward the kidney. Urine was collected and separated, that from the left ureter was clear, and negative on examination, that from the right was slightly cloudy and contained red bloodcorpuscles. Cultures from both urines proved negative. After withdrawal of the ureteral catheters, one of Albarran's solid bougies was passed into the right ureter, and the cystoscope then withdrawn. An attempt was then made to pass one of Albarran's catheters, which are arranged to pass over the bougie, which has been placed in the ureter and thus acts as a guide, with a view

of thus pushing a large catheter up the right ureter, and dilating it below the stone. The catheter, however, refused to pass into the ureter around the bougie, and after several failures the bougie was withdrawn. The catheter was apparently caught each time upon the edge of the ureteral orifice and failed to enter the ureter. The diagnosis of an obstruction, probably a small stone situated about 2 cm. above the bladder was made. It was interesting to note that there were no changes in the ureteral orifices as seen in the bladder, probably owing to the short duration of the disease.

Urine from the right ureter contained 0.012 gm. urea to 1 cc.

July 22. There was considerable urethral irritation after cystoscopy for 3 or 4 days. Pain in kidney and ureter and back had subsided before cystoscopy, and the latter had no effect upon it. It did not return afterward, and patient is still free from pain. Urination is about normal in frequency and in amount. Patient slept well last night, and is gaining in strength.

Examination. Urine slightly cloudy. No infection, no pus, uric acid crystals and a few leukocytes. Urine pale, slightly acid. Patient discharged, with instructions to take urotropin, 7 grains, 3 times daily and to drink large quantities of water.

August 9, 1901. On July 27 at 12 o'clock at night, patient had another attack of colic in his right side. It began with gnawing pains in the region of the hip (right). These soon became worse, and extended down into the right testicle. After about 3 hours the pain became so severe that he was given morphine. The patient noticed no blood afterward, and has passed no gravel. He is now free from pain and feels well. Urine, acid, shreds in first glass, no bacteria. He is taking 7 1-2 grains urotropin, 3 times a day.

October 11, 1901. Patient was last seen August 8. Since then has spent 6 weeks in Jackson's Sanitarium, Dansville, New York. Took baths, out-door exercise and massage, and gained about 17 pounds. Had no attacks of pain in his kidneys or bladder while there. One week ago had again the old pain in the lower right back lasting about 2 hours. He then had an interval of freedom from the pain for 2 hours, and the pain then came on again and lasted 2 hours. Since then has had no pain at all. This attack of pain followed a slight excess in the use of alcoholics during the day previous. He now urinates a little more frequently than before the trouble began, but drinks much more water; gets up once at night, occasionally twice; during the day goes 3 or 4 hours between urinations. Has passed no blood, has had no pain in bladder or penis. Has passed no calculus.

Examination showed normal urine.

Radiograph taken to-day shows no shadow in the region of the right ureter. The plate is not very satisfactory, but no stone is to be seen.

March 5, 1902. Patient has not had an attack, nor any pain since he was here last October. He has not to his knowledge passed any calculus; has felt perfectly well, and followed his usual occupation. He has drunk considerable water, but not as much as during summer. He has passed his urine in considerable amount, his digestion has been good, and he has lost no weight.

If he retires at 11 o'clock he generally has to get up at 4 to urinate. When he retires later he does not have to urinate until arising in the morn-

ing. During daytime passes urine about every 4 or 5 hours, there is no pain on urination, and no vesical or bladder irritation. Sexual powers are normal. In fact, he feels in perfect health.

Examination. Patient very well in appearance. Bimanual palpation in region of right kidney shows nothing abnormal, there is no tenderness, and no enlargement of kidney to be made out. Palpation along the course of the right ureter elicits no tenderness or pain, and no muscular spasm. Examination of left kidney and ureter negative. Genitalia negative; neither testicle retracted.

Rectal Examination. Definite but slight induration in the region of the left seminal vesicle and upper end of prostate. Region of right seminal vesicle normal. Bimanual examination; pressing the external hand well down into the pelvis, and pushing the bladder toward the finger in the rectum, a splendid examination of the region above the prostate is secured, but nothing abnormal felt. Nothing simulating a small stone in right ureter, and no tenderness elicited. Urine voided is perfectly clear in all 3 glasses, and very pale, specific gravity 1010, no albumin and no phosphates, microscopically negative. Urea 0.006 gm. to 1 cc.

Under the influence of local cocaine anesthesia of the urethra and bladder, cystoscopic examination was performed. The bladder was apparently perfectly healthy. The ureteral orifices were normal, and of the same size. There was no increased reddening around the right ureter, from which strong jets of urine were coming at intervals of 45 seconds. The urine was perfectly clear. From the left ureter the interval seemed to be more frequent than from the right. *Casper's cystoscope was then introduced, and the right ureter easily catheterized. The catheter passed easily upward as far as we wished to push it (for a distance of 9 or 10 inches). There was no obstruction met with, and no grating to be felt.* Urine at once began to flow from the catheter, coming in drops, 2 or 3 at a time, with intervals of one or 2 seconds. In 15 minutes about 20 cc. of urine were collected. The left side was then catheterized.

The above operations produced very little pain, and were not followed by hemorrhage. No foreign body, or stone to be seen in the bladder. Urine from right side negative. Urea 0.007 gm. to 1 cc.

Remark. The radiograph and ureter catheter both show that the stone has been passed, and justify the waiting policy adopted.

CASE IV. THREE LARGE CALCULI REMOVED FROM THE LOWER END OF THE LEFT URETER THROUGH EXTRAPERITONEAL (ILIAIC) INCISION. RECOVERY.

I am indebted to Dr. Finney for the privilege of reporting this case.

H. E., aged 33 years, admitted to Johns Hopkins Hospital, July 12, 1901. Surgical No. 12,089.

Complaint: Renal calculus.

Past History. Typhoid fever at 10, and the present illness seems to have come on soon after the convalescence from that, though he had scarlet fever when a year old, and mother says that bladder and kidneys were involved at that time.

Present Illness. As a boy, patient had pains in the back and lumbar region which came on at intervals of from 3 to 6 months. These attacks would often be relieved by continued pressure over the painful area. In 1891, patient had a very severe and prolonged attack in the region of the left kidney, lasting 4 or 5 days, during which time he was kept under the influence of morphine. After this attack subsided he passed a good sized stone. Milder attacks continued at irregular intervals of weeks or months, until 1897, when he had a second very severe attack. Since the first attack on the left side in 1891 the pain has all been on the right side. This attack was so sudden and severe that he fell to the ground and had to be carried to bed. A short time after the subsidence of the pain he passed a white stone, very rough and about the size of a bean. These attacks continued intermittently until December, 1898, when the third severe colic seized him. The usual intermittent attacks followed until December, 1900, when the fourth severe crisis occurred. During this attack the urine was examined for the first time and albumin found to be present. About this time the patient was cystoscoped by Dr. Michon, of Paris; he was unable to locate the right ureter, but was able to pass a catheter into left ureter, until it was blocked about 3 cm. from the vesical orifice, by a mass which the doctor thought was pus. He was put upon tonic treatment and gained rapidly in weight, but has continued to suffer from intermittent attacks of pain in his back. His urine has been very purulent, and at varying intervals since the age of 10 he has noticed that his urine was a very dark, mahogany-brown, probably due to blood.

Status Praesens. During an attack of moderate severity the pain is dull in character and lasts 4 to 5 hours, but in the severe attacks the duration is much longer. The pain does not radiate to the testicle, is never felt at the end of the penis, but frequently an aching sensation is present there. When walking he is often seized with a sudden sharp pain, in the region of Poupart's ligament, which momentarily causes him to double up.

Examination. Patient is a large, well nourished man. The mucous membranes are of good color, the heart and lungs negative. Abdominal examinations were negative, but very unsatisfactory on account of the rigidity of the muscles, which prevented one from discovering anything definite in regard to the left kidney or ureter.

On rectal examination no stone was to be felt, not even by bimanual examination.

Vesical examination with searcher gave negative results (cystoscope not submitted to). Urine analysis July 13. Cloudy; specific gravity, 1010; alkaline; albumin, a trace; sediment, heavy, white. Microscopically pus cells and cocci. Urine very purulent. X-ray photograph: An excellent radiograph was obtained, and showed a considerable shadow along the course of the left ureter in the pelvis. The shadow was about 5 cm. long, and from one to 2 cm. in width. The upper end appeared to be near to the pelvic bones posteriorly and the anterior end was well forward. The positive diagnosis of calculus of the lower end of the left ureter was made.

Operation, July 23, 1901. Oblique incision, and exploration of left kidney through the cortex, no stone present, but ureter dilated. The ureter followed

by blunt dissection with the finger, and stone discovered below the brim of the pelvis. A second incision above Poupart's ligament in the left groin, extraction of 3 large calculi from the pelvic portion of the ureter. Suture. Ether anesthesia.

An oblique incision was made in the left lumbar region parallel to the crest of the ilium, started as a gridiron incision; later the muscles cut across. Kidney was exposed with some difficulty on account of adhesions. It was small and more or less lobulated. It was thoroughly palpated; likewise the pelvis and the beginning of the ureter; and nothing could be found. An incision was then made into it and catheter passed down, apparently ran into the bladder (later it was discovered that this was not so). By blunt dissection the ureter was then exposed to the pelvis, and the finger of an assistant introduced into the rectum. With some difficulty a stone was then discovered high up in the pelvis. A second incision was then made in the form of a gridiron in the left iliac region, and the muscles separated, peritoneum pushed up, and the iliac vessels exposed and followed down to the ureter, which was easily located on account of the catheter which had been left in it.

Just below the brim of the pelvis the upper end of a calculous mass was felt, which extended from that point downward and along the horizontal course of the ureter, to within 2 cm. of the bladder. The whole length of the mass being about 5 cm. and diameter varying from 1 to 2 cm. The ureter was opened upon the upper end of the calculous mass and a stone 1 cm. by 1 1-2 cm. removed. A second stone a little smaller was likewise removed. It was then thought that these were all, but with a finger in the rectum Dr. Hunner was sure that a third mass could be felt, and the operator was finally able to feel it with his finger above. After considerable difficulty this last stone was removed; it was rough and apparently situated in a cul-de-sac in the bladder wall. After its removal a large blunt probe was easily passed into the bladder demonstrating the absence of any definite stricture. The ureter was considerably torn by these manipulations and 8 interrupted silk sutures were required to close it. The attention was then turned to the kidney from which there was still some oozing, and it was deemed best not to remove the gauze packing from it, and this was accordingly brought out of the wound. Another gauze drain was placed in the lower wound leading down to the sutured ureter. The smaller wounds were then closed on each side of the drainage with silver mattress sutures, and the skin closed with subcutaneous suture.

Convalescence. On the night following the operation temperature rose to 102°, and during the next 2 days varying between 100.3° and 100.7°. After that the temperature gradually fell and remained normal after the 14th day. On the second day patient voided 1700 cc. of urine, and on the next day 2600 cc., the urine being slightly bloody. During this time patient received enemata of 400 cc. salt solution with potassium citrate 30 grains every 4 hours. This was discontinued on the fifth day, and the amount of urine secreted became less. With the exception of moderate amount of nausea patient had an uninterrupted convalescence. The drainage was gradually removed from the wounds and there was at no time any leakage from the ureteral suture. Patient was discharged 43 days after the operation.

Report by letter February 1, 1902. Much improved, but not well, urine purulent, considerable vesical irritation.

A STUDY OF CASES IN THE LITERATURE.

A careful review of the literature shows that rapid strides have been made in the past two years since Morris asserted that no case of calculus impacted in the lower end of the ureter in the male had been operated upon.

A field which had been held to be beyond the reach of the surgeon has now been successfully reached in various ways.

The several routes through which calculi have been extracted from the pelvic portion of the ureter are as follows: We have grouped the cases together according to the operation performed, and will take them up, not in order of priority, but anatomically, beginning with the intravesical, then successively the perineal, the intrarectal, the pararectal, the sacral, the iliac (extraperitoneal) and the intraperitoneal, describing at first the operative variations of each.

I. THE INTRAVESICAL ROUTE.—Those in which the calculus has been removed from within the bladder. This has been done in the male in three ways; (a) through a perineal urethrotomy, (b) through a suprapubic cystotomy and (c) through the urethra without incision, by means of a male catheter cystoscope.

a. In his recent book Morris³ says: "The perineal incision is said to have been practiced by Desault and Garengat" for extraction of ureteral calculus. We unfortunately have no description of their case.

In 1884, Morris had suggested that a stone, impacted in the vesical part of the ureter, should be removed through a perineal urethrotomy, or a suprapubic cystotomy, and had devised a special knife for this purpose, but he has never made use of the method.

b. In four cases calculi have been removed through suprapubic incision.

Bishop,⁴ in 1899, published two cases and Newman,⁵ in 1900, two cases.

Bishop's cases were as follows:

Case I. R. S., male, aged 13 years, admitted July, 1883. He had complained a long time of symptoms of vesical calculus and sounded with that idea. A stone was easily felt, but appeared more fixed than normal. It did not alter its position when the patient's own position was changed. Suprapubic cystotomy was performed and a calculus found with the finger, a portion free in the bladder cavity, the rest of it held in the lower end of the ureter. It was easily removed with the finger, aided by a small spoon. The stone was constricted in its middle at the point where the lower end of the

ureter had grasped it. The size of the stone was about an inch long, and that portion in the ureter about one-half inch in diameter. The patient made an uninterrupted recovery, the suprapubic wound healing within 2 months, and he is now well.

Case II. Male, aged 7 years, admitted November 2, 1898, complaining of pain on urination. The pain was referred to the end of the penis and had been present since he was a baby. Examination of urine showed no infection. Three weeks after admission note was made that "he had had no pain, undue frequency, nor difficulty of urination since entering the hospital. Examination: Three small vesical calculi found." On December 17, suprapubic cystotomy was performed, and a calculus weighing 2 ounces was removed from the bladder, which was then sutured, and the abdominal opening also closed. The wound broke down on the third day after the operation, the urine escaping through the wound. Eight days after the operation patient first began to complain of pain in the region of the right kidney, and had a temperature of 104°. During the next 4 days there was intense spasmodic renal colic with an up and down temperature. Rectal examination was made, a hard fixed body was felt on the right side at the base of the bladder, and a diagnosis of impacted ureteral stone made. On the thirteenth day the bladder wound was fully opened up while an "assistant fixed the stone by pressure from behind with his finger in the rectum, the stone was teased out from above, and a gush of pus followed its removal." Convalescence was uninterrupted.

Newman's cases were as follows:

Case III. Male, aged 35 years. History of intermittent attacks of renal colic for several years. Latterly patient complained greatly of frequent micturition, but suffered little or no pain during the act, and only twice had profuse hematuria. There was no pain in the region of the kidney, and both rectal and abdominal examinations were negative. The cystoscope showed a cherry-sized tumor with smooth, well-vascularized surface, immediately over the right ureteral orifice, which was diagnosed fibroma of the bladder. Suprapubic cystotomy was performed and the swelling seized with volsellum forceps, but as soon as pressure was made the tumor cracked, and a little traction brought away a calculus, with a thin but complete covering of mucous membrane. No note was made as to result.

Case IV. Male, aged 54 years. Admitted April, 1898, with history of having suffered from pain in the bladder and hematuria for several years. No calculi had been passed. The symptoms had always been entirely vesical. Cystoscopic examination was unsuccessful on account of hemorrhage from an enlarged prostate. With searcher vesical calculus was discovered. Suprapubic cystotomy was performed and a rounded intravesical nodule of the size of a cherry discovered at the orifice of the right ureter. On laying hold of it with a volsellum forceps it was found to be hard, but on pressure it broke, showing it to be impacted ureteral calculus. No note was made as to result.

c. Cystoscopic Extraction.—This method of removing a calculus caught in the lower end of the ureter has only been performed (as

far as I can find from a careful search of the literature), in the case (III) reported by the writer above. As noted above, the patient, male, aged thirty-one years, had an attack of severe pain in the left kidney three months before, and two days later the pain suddenly descended to the bladder. After that he suffered with a constant desire to urinate, and pain radiating from the base of the bladder to the glans penis.

The cystoscope showed a calculus engaged in the orifice of the left ureter, but projecting somewhat into the bladder cavity. With Casper's catheterizing cystoscope it was possible by lateral pressure with the end of a ureteral catheter to dislodge the calculus, which rolled down into the base of the bladder, leaving a large, round patent ureteral orifice. Nine months later patient reported that he had had no further attacks.

It seems surprising that no calculi have been removed in the female through the simple open cystoscope of Kelly, which can be so effectively used for intravesical operations. Kelly has constructed forceps for that purpose, but no case has yet occurred for their use on impacted ureteral calculi.

An interesting case in which Kelly dilated a slight stricture of the lower end of the ureter through his cystoscopic tube, which operation was followed by an escape of a calculus into the bladder nineteen hours later is recorded.

II. THE PERINEAL ROUTE.—This was proposed, in 1898, by Fenwick,⁶ who stated that if a stone could be detected by rectal examination, it could be easily and safely extracted through a transverse perineal incision in the male. In Fenwick's opinion, if the calculus is found below the pelvic brim the incision should be perineal or vaginal.

The method has been used by its author in the following case:

Male, aged 18 years, seen March, 1895. Patient complained of pain in the glans penis after micturition, and occasional pains across the back. The onset symptom was blood at the end of micturition. Trouble began 18 months ago, there was no frequency of urination. The urine was healthy. The rectal examination showed the prostate to be normal. Cystoscopy showed a prolapse of the right ureter, and crowning the everted mucous membrane was a villous tuft. Thinking that this villous papilloma led to the prolapse Fenwick removed the prolapse and villous growth through a suprapubic cystotomy. On the following night it occurred to him that this prolapse must have been due to an irritation higher up in the ureter. He therefore examined the rectum and found high up a stone the size of a marble in the right ureter. After the suprapubic wound had healed a stone was extracted through a small, transverse, perineal incision. Fenwick remarks that he had no hesitation in adopt-

ing this route, for it had become familiar to him in resecting pieces of the seminal vesicles and operations upon the prostate. With the aid of long, narrow tongue retractors the dissection between the rectum and the lower urinary tract was made. He rapidly reached the ureter, being guided to it by feeling the stone in it forced within reach of his finger by the pressure of the dresser's hand upon the abdomen; the stone was then extracted by a longitudinal incision, and was found to be about the size of a small peach stone. A thick glass drainage tube was passed into the ureter, and stitched at its lower end into the perineal wound. The patient made an uninterrupted recovery and the fistula healed rapidly.

III. THE INTRARECTAL ROUTE.—This has been employed only by Ceci,⁷ who, in 1887, reported a case in which he had operated to remove calculi through the rectum. The patient, a man, had suffered for several years with symptoms of ureteral calculus, and on rectal examination a large, hard mass was found in the region of the left ureter. Operation was performed with the patient in the position for perineal cystotomy. The anus was dilated and washed clean. A bistory was then inserted, an incision three cm. long made upon the tumor and seven stones removed from the dilated left ureter. Further examination then revealed calculi in the right ureter, but the operation was postponed, but never performed on account of the death of the patient thirty-six hours later.

IV. THE PARARECTAL ROUTE has not been used in the male, and only twice in the female, both by Morris, who described the method in his book,⁸ in 1901.

An incision five inches long was made parallel with the sacral spines and two inches distant from the middle line, extending from the level of the third sacral spine to a point one and one-half inches beyond the tip of the coccyx. The edge of the gluteus-maximus muscle and of the great sacrosciatic ligament were divided, a bougie passed into the rectum and another into the vagina to act as guides. A sound was passed into the bladder and a finger into the vagina, and after some trouble the ureter was found, and the part containing the impacted stone pushed into the wound, the ureter incised and the calculus removed. The patient recovered, and the urinary fistula closed in four weeks. The second case likewise recovered.

Morris says: "When a stone is impacted in the ureter near the lower end, but too far off to be removed through the bladder or vagina, the sacral route should be employed. I have operated successfully in two cases by this route. In the male the prerectal route is available." The pararectal route is but a modification of,

V. THE SACRAL ROUTE, which was suggested by Cabot,⁸ in 1892, but which has so far never been employed in the male or female. Cabot gave his reasons for the operation thus:

"If the stone is already projecting well into the vesical cavity, or has actually passed through the muscular coat and is lying under the mucous membrane, it may be removed easily and successfully through the bladder, and this would certainly be the method of choice. When, however, the stone has not reached the bladder cavity, and an incision of the bladder wall is therefore necessary to uncover it, this operation is a dangerous one, as urinary infiltration about the base of the bladder is likely to follow it. It would be better then to reach the stone in the vesical end of the ureter by an incision from the outside, which would open a way for the escape of any urine that was afterward extravasated."

"As has been said, this part of the ureter cannot be reached from above, and it is necessary, therefore, to seek some approach to it from below. It occurred to me that a modification of the incision employed by Kraske for excision of the rectum would afford the desired access to this lower portion of the ureter, and dissections have confirmed me in this belief."

"I find that an incision along the border of the sacrum, on the side upon which it is wished to reach the ureter, stopping just below the point of the coccyx, with a division of the sacro-iliac ligaments and the removal of the coccyx and the lower part of that side of the sacrum, lays open the pelvic cavity in a most satisfactory way, and gives easy access to the lower three or four inches of the ureter. The only difficulty in this dissection is in finding the ureter, which in its collapsed state cannot be easily made out. The peritoneum is very thin and there is considerable danger of wounding it during a protracted search."

"For a stone impacted in the male this would seem a very ready and safe incision for reaching this portion of the ureter. The space afforded is ample for a careful inspection of the parts, and the opening, being dependent, affords good drainage."

VI. THE INTRAPERITONEAL ROUTE has never been employed in the male, and only three times in the female for calculus lodged in the pelvic portion of the ureter. One of these patients died from peritonitis. The great majority of writers on the subject condemn this route, as being dangerous, and generally more difficult of performance (especially as to suture of the ureter) than an extraperitoneal route, and Morris insists, that even in cases in which the diagnosis has been made by laparotomy, and a ureteral calculus thus detected, no attempt should be made to remove it through the abdomen. Several operators have made use of the hand in the abdomen to push the stone up to the kidney, and then extracted it through the loin.

VII. THE ILIAC (EXTRAPERITONEAL) ROUTE.—Although Bardenhauer, in 1882, removed a calculus from the upper end of the ureter by an extraperitoneal incision, no case in which a stone had been removed from the lower segment of the ureter (in the depths of the pelvis) was published until 1890, when Twynam detailed a case.* Since then four other operators have used this method, viz: Morison, Israel, Finney and Young; in all seven cases.

I. Twynam's Case:

A boy, aged 8 years, who had suffered with pain in the abdomen and hematuria at irregular intervals for 16 months was seen first by the operator in January, 1899. He then had a temperature of 104° F.; there was a distinct tenderness in the left flank, and the urine contained pus.

On January 6, an exploratory laparotomy in the left linea semilunaris revealed a small stone in the lower end of the right ureter, but nothing could be found in the left kidney or ureter. The abdominal wound was closed, and nothing further attempted then.

On February 23, the temperature rose suddenly to 106° F. and 3 days later convulsions set in. Although the patient was unconscious, an operation was then undertaken to remove the stone. "An incision was made as for ligating the iliac artery," some difficulty was found in isolating the ureter, but the stone was finally found at a point and extracted through a small incision, and the wound in the ureter closed with silk sutures. A tube drain was introduced to the bottom of the cavity, and urine escaped for 5 days. No further notes are made, but Morris^a records the case as having recovered.

In commenting upon the case, Twynam said that the striking points about the case were (1) the difficulty of diagnosis, owing to the fact that a stone at the bottom of the right ureter caused pain in the region of the left kidney; and (2) in the novel method of removal of stones situated as low down in the ureter.

II. Morison's Case, reported in 1894¹⁰, was as follows.

Suppression of urine due to calculus obstructing the right ureter; retroperitoneal exposure of the ureter to its bladder entrance. Removal of 2 calculi. Opening of ureter, suture. Death immediately after operation. Autopsy, left ureter found impacted by stones in its middle.

Male, aged 46 years, admitted August 22, 1891. Four and a half years ago the patient had for the first time an attack, characterized by severe pain in back and right side, which continued for 3 weeks, and at the end of this time passed 2 stones about the size of peas, and had no further trouble up to the present time. Present attack came on suddenly, 9 days before admission of the patient, being characterized by severe pain in the right side just above the hip bone, and from there passed into the right testicle. For 3 days before admission he was frequently sick, but continued at his work until the day before admission, when severity of pain caused him to come to the hospital.

During his first 3 days in the hospital he voided practically no urine, on the fourth day he voided 40 ounces, but suppression again ensued. During

this time he was frequently nauseated and had severe pain. On the fifth day he was drowsy and stupid. Diagnosis of calculus of the right ureter with cessation of function of the left kidney was arrived at, and immediate operation decided upon. The right kidney and entire ureter were successively explored by an incision beginning in the loin and extending to Poupart's ligament. An inch from the bladder 2 stones were palpated in the ureter, and removed through an incision over them, and the opening closed with catgut. The patient's breathing had become more difficult and ceased just before the completion of the skin suturing. At autopsy, the left ureter was found completely blocked about the middle by a stone, above and below the obstruction the ureter was dilated. The left kidney was sacculated, no appearance of healthy substance being left, and the right kidney was also sacculated and much diseased.

In his recent book Israel¹¹ has presented a wonderful array of operations upon the kidney and ureter, and among his 297 cases I find three of stone impacted in the lower end of the ureter in the male, and removed by operation.

Israel's Cases:

Case III. Stone in the juxtavesical part of the right ureter. Ureterolithotomy, nephrolithotomy. Death from heart failure.

Male, aged 31 years, admitted June 16, 1900, died June 20, 1900. Six years ago the first kidney colic on the right side. Since then frequent attacks up to the present time. In November, 1897, an oxalate stone which had become caught in the urethra was removed by incision. Neither movement of the body nor riding in a wagon, brought forth the attack, nor increased the pain present.

Status Presens. Very pale man, musical systolic murmur in the aortic region, pulse 72. Kidneys neither palpable nor sensitive. Palpation of ureter neither from abdomen nor from rectum painful. No stone to be felt. A few red bloodcorpuscles in the urine and a trace of albumin. On July 18, operation, chloroform, ether, duration of narcosis, 2 hours. Incision in right loin, kidney exposed, showing a slightly adherent fatty capsule. No stone was to be felt. By nephrotomy one found a slight dilation of the pelvis, but no stone. The ureter was little dilated and not thickened. A sound could be passed down near to the bladder, but not into it. A lower extraperitoneal incision was then made ending at a point midway between the right anterior iliac spine and the outer edge of the rectus. The retroperitoneal room was laid bare and the ureter with the same in it exposed, and in its juxtavesical end a small stone was felt, which was easily shoved upward to within 7 cm. of the kidney pelvis, but there became caught and was removed by ureterotomy. The ureter wound was closed with 4 fine paramucosal sutures. The kidney was also closed. Drainage to ureter and kidney sutures. Abdominal wound closed. For the first 24 hours patient did well, next day pulse increased in frequency up to 132, respiration rapid. During the afternoon patient failed suddenly, pulse became imperceptible and patient died 54 hours after operation.

Autopsy showed myocarditis and fatty degeneration of heart. The right kidney was filled with a clot of blood, but the ureter was pervious at point of suture. The pelvis of the left kidney was dilated, the cortex thinned and the left ureter greatly distended, especially near the lower end where there was an ampulla-like dilation 5 cm. above the opening into the bladder. No further note was made as to cause of dilation, whether stricture, stone or what. No note on bladder.

Case IV. Pyonephrosis of left side with ureteral calculus 17 cm. long, caught at the lower end of the ureter. Total ureterectomy and nephrectomy. Cure.

Male, aged 33 years, admitted May 26, 1897. Symptoms pointing to left side for 9 years with colicky pains radiating in the direction of the spermatic cord. Pains returned about every 2 or 3 months. Urine became cloudy in 1891, urination was always without pain, of normal frequency except during times of colic, when there was marked vesical irritation. Last colic was about year before, pain being felt in the left kidney region.

Examination. Under pole of left kidney palpable and very tender, urine acid, small amount of albumin and pus corpuscles present. *Cystoscopic examination* showed that left ureteral papilla was prominent and cone shaped, and emitted clouds of turbid urine. On May 26, left-sided nephrectomy. Ureter found the size of the thumb at its upper end. No attempt was made to remove the ureter. The kidney removed showed great dilation of the kidney pelvis and thickening of the cortex. Patient did well, but the urine remained cloudy and patient complained of a very painful tenderness along the left ureter and extending toward the testicles, which gradually increased in severity. After the patient got out of bed the pain in the testicle became much worse. Rectal examination caused tenesmus of the rectum, and one felt now at the lower end of the ureter extending up along the side of the pelvis a very large stone (no previous examination recorded).

June 23, 1897. Ureterotomy, incision began 2 fingers' breadth above the external inguinal ring and extended upward parallel with Poupart's ligament to a point opposite the anterior superior spine. The peritoneum was easily shoved to one side, and a long stony mass 17 cm. long, the size of the thumb, found in the ureter, which was adherent to the peritoneum, and shoved over with it. The calculus extended down to within an inch of the bladder. The wound was then extended and the ureter dissected free for its entire length. The lower end was then ligated with catgut close up to the bladder, and the ureter divided by thermocautery, wound was packed with gauze. Result, healing per primam, and ultimate cure. *Examination of stone:* The ureter had been removed with a stone in it, the length of the stone is 17 cm., circumference 9 cm. and composed of phosphates and carbonates of calcium and magnesium.

Case V. Left pyelonephritis. Stone in the pars juxtavesicalis of the ureter. Empyema of the ureter. Nephrectomy. Four weeks later total ureterectomy. Cured.

Male, aged 39 years, admitted February 3, 1898. Pains in left side for 2 years at intervals from every 2 or 3 days to every 2 or 3 weeks associated with

nausea and night sweats. Micturition painful at the end, frequency of urination generally normal, but increased during attacks. Hematuria never marked. Pus found present. Abdominal palpation revealed a very much enlarged left kidney. On rectal examination a considerable induration was felt above the prostate extending upward to the left, which extended along the lateral wall of the true pelvis, and which was finally shoved upward by the pressure of the examining finger. Nothing was to be felt by bimanual palpation. The operator decided that there was without doubt a stone in the place where the ureter changes from the descending direction into its horizontal portion over the pelvic floor. The urine was acid, contained considerable albumin and numerous pus cells.

The cystoscope showed pus streaming out of the left ureter. Above the ureteral papilla was a deep furrow. The right ureteral orifice was normal. An incision was made in the loin, exposing the left kidney, there was considerable pus in kidney cortex, and on this account the kidney was extirpated. No attempt made to attack the ureter. Five days after the operation a severe attack of colic in left ureter with rise of temperature came on, and the stone in the left ureter was plainly felt per rectum. One month after first operation total ureterectomy was done, through Israel's incision. In shoving away the peritoneum the ureter went with it and appeared as an enormously thick cylinder of the size and appearance of a greatly filled rectum, but it was easily isolated from the surrounding adhesions. Following the ureter with his finger the operator found a stone impacted close to the bladder.

Ureterectomy was decided upon, and the ureter was therefore tied doubly beneath the stone, divided and freed from below upward. The wound was closed with drainage above and below. The extirpated ureter was 22 cm. long, over 3 cm. in diameter and greatly thickened. The calculus was as large as a plum and weighed 12 gm. Result: Healing by first intention. Ultimate result not given.

VI. *Finney's Case.* This case has been reported in full above, No. IV.

Male, aged 33 years, with history of attacks of renal colic for 10 years. Abdominal and rectal examinations negative. Urine very purulent. Radiograph showed a long calculous mass in the lower end of the left ureter. Operation: Kidney explored through lumbar incision, no stone present; ureter dilated. Second incision lower down (iliac); extraperitoneal extraction of three large calculi. Suture of ureter with silk. No leakage. Report 7 months later, patient well.

VII. *Young's Case,* reported above in full, No. I.

Male, aged 29 years. History of pain in bladder and left kidney since 2 years of age. Examination of abdomen and rectum negative. Urine contained a few red bloodcorpuscles. Cystoscope showed prominent left ureteral papilla, stricture of ureter, impassable intramural obstruction.

Radiograph showed calculus at lower end of left ureter.

Operation, Israel's incision (lower half) extraperitoneal extraction of stone, suture of ureter. No leakage. Examination after 6 months, well.

RÉSUMÉ.—We have therefore found fifteen cases recorded in which calculi have been removed from the lower end of the ureter in the male. We have included cases in which the stone was lodged in the *pars intermedia* pelvis of the ureter, but have had to exclude those in which the impaction was at or near the pelvic brim. In this category are the cases of Kirkham, Keen and others.

The results obtained by the different routes were as follows:

- I. Intravesical, six; result not noted, three; recovered, three.
- II. Perineal (prerectal), one; recovered.
- III. Intrarectal, one; died.
- VII. Iliac (extraperitoneal), seven; recovered, five; died, two.

Total, fifteen cases: Result not noted, three; recovered, ten; died, three.

GENERAL CONSIDERATION OF THE ANATOMY AND PATHOLOGY.

The ureter just before reaching the pelvic brim crosses the iliac arteries, from there it passes in front of the *alæ* of the sacrum then over to the ischium where it makes a sharp bend, turning inward and running in a straight line until it reaches the bladder.

Measurements of the distance between the two ureters show that they are about five cm. apart at the brim of the pelvis, where they cross the iliac arteries, and also about five cm. apart where they enter the posterior wall of the bladder. At the para-ischial bend they are about ten cm., or double the distance above and below. Measurements also reveal that the distance from the bend at the pelvic brim, to the para-ischial bend is about five cm. and that the distance from this point to the entrance into the posterior wall of the bladder is also five cm. The course of the ureters within the pelvis, therefore, form quite a perfect hexagon each side (and radius) of which is five cm., as shown in the diagram (Fig. A) thus: A and A' represent the iliac bends and are, of course, five cm. apart. B and B' represent the para-ischial bends and are, of course, ten cm. apart (double the radius). C and C' the points of the juncture of the bladder and ureter, also five cm. distant. AB, A'B', BC and B'C' are likewise five cm. We see that such a hexagon corresponds quite accurately with the average anatomical distance of the ureters, and gives at once an easy and fairly accurate idea of their intrapelvic course.

The ureter, as you are aware, is not a tube of uniform caliber, but as shown in the accompanying photograph of anatomical preparations (Fig. B) presents normally four points of narrowing, the first just below the renal pelvis, the second where it crosses the iliac vessels,

the third where it enters the muscular wall of the bladder and the fourth at its vesical orifice. Between these points of narrowing it swells out in a fusiform manner as particularly shown in one of the figures.

These points of narrowing are of great importance in determining the lodgment of the calculi, and the statistics show that they are found impacted at these points with much greater frequency than at all other points of the ureter combined.

Calculi, then, which have passed the first and second narrowings, are most apt to be lodged at the junction with the bladder or at its vesical end.

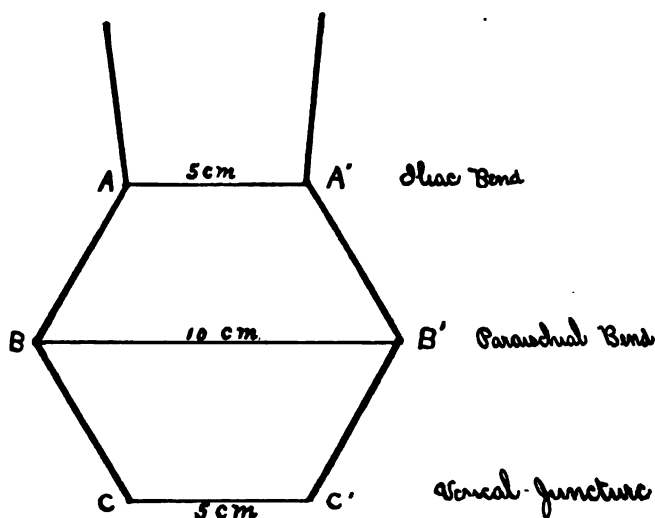


FIG. A. The ureteral hexagon.

The occasional lodgment at the point half-way between the pelvic brim and bladder is probably to be explained by the sharp bend which the ureter makes at that point, the para-ischial bend.

The course of the lower ureter may be conveniently named from its relation to neighboring structures thus: (Fig. 1.)

The iliac portion, where it crosses the iliac vessels; the parasacral, where it passes in front of the sacrum; the para-ischial, where it makes a rather sharp bend above the ischial spine; the juxtavesical, that portion just above the bladder; the intramural, that portion within the muscular wall of the bladder, and the intravesical, the orifice within the bladder cavity (pathological).

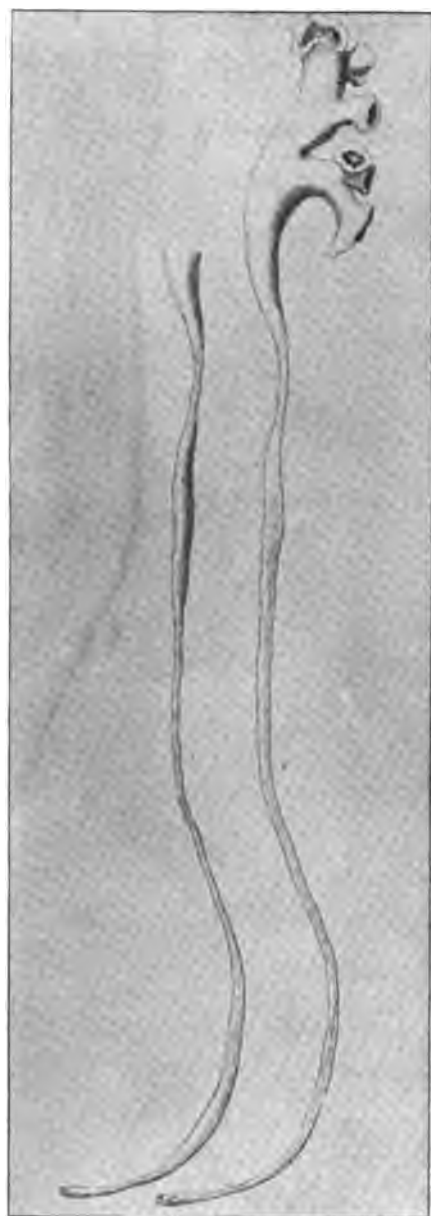


FIG. B.

In the sixteen cases collected in this paper the points of impaction of the calculi were as follows:

Juxtavesical, seven; intravesical, five; para-ischial, one; intra-

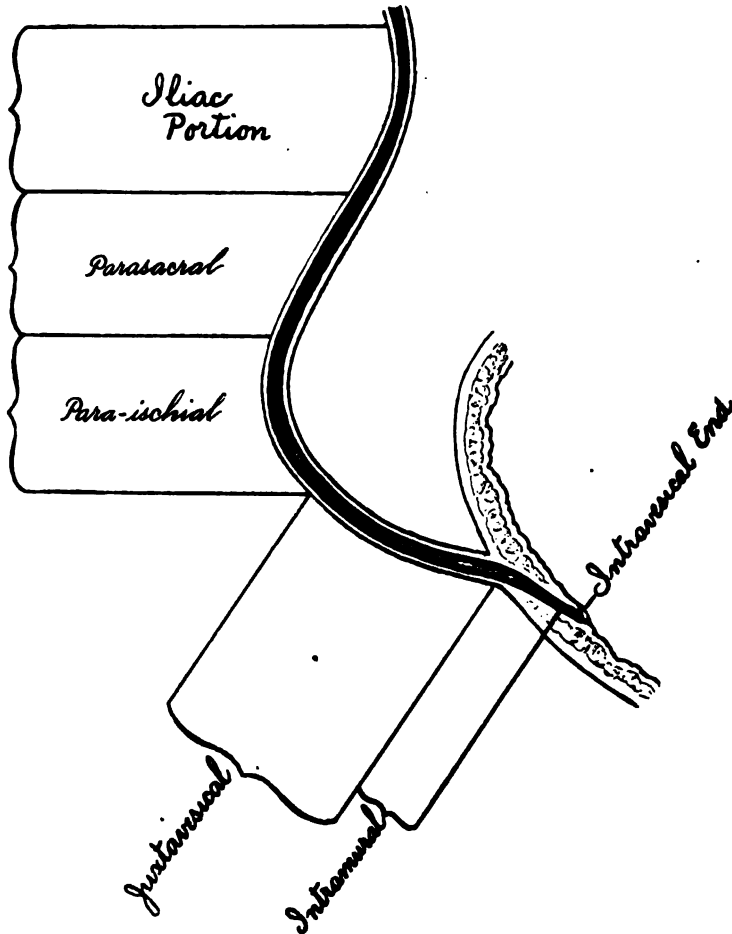


FIG. 1. The normal ureter from the iliac bend to its intravesical orifice and its subdivisions.

mural, one; juxtavesical and para-ischial, one (three stones); juxtavesical to iliac, one (one stone seventeen cm. long).

As only the cases of calculi of the lower end of the ureter in the male were considered the frequency of calculi at the iliac region is not shown.

In the female the para-ischial portion just behind the broad ligament is a very frequent point for the stoppage of stones, while it is not so common in the male. In the female also several cases of intramural incarceration of calculus have been reported, but only one in the male.

The accompanying diagrams show the positions and forms of lodgment of calculi as outlined above. (Figs. 2-6.)

The intravesical type may be of two forms: One in which the calculus, entirely covered by mucous membrane, presents a rounded

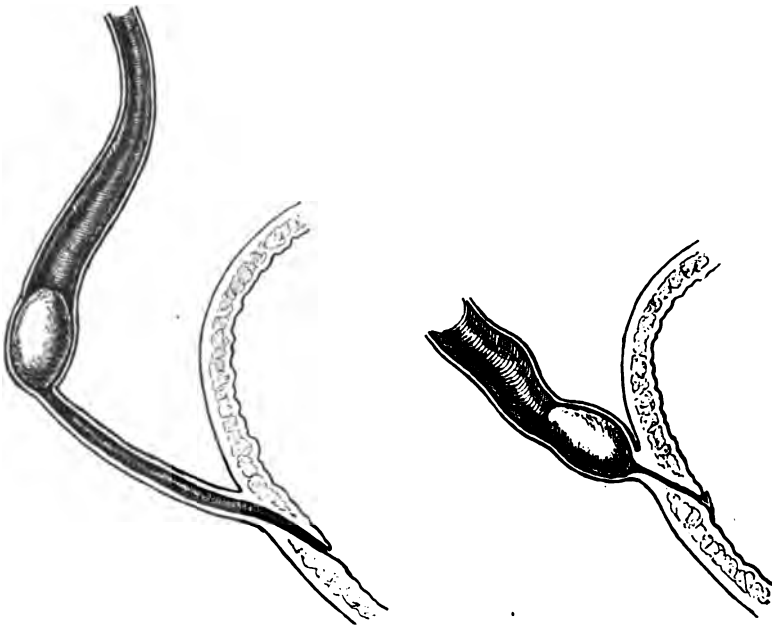


FIG. 2. Calculus impacted in para-ischial portion. FIG. 3. Calculus in juxtavesical portion.

sessile or pedunculated tumor in the bladder as in the two cases of Newman (Fig. 5); and that in which the stone is partly in the bladder and partly within the ureter—being constricted at the orifice—the “wheat sheaf” type as in Bishop’s first case. (Fig. 6.)

This nomenclature gives briefly and accurately the points of impaction of stones and should thus avoid the great confusion and inaccuracy of description which now exists in the literature.

The pathological reasons for the impaction of stones in certain parts of the ureter are both intra-ureteral and extra-ureteral. Of the former strictures are the most common, and probably most often the

result of the injury, laceration, inflammation, etc., caused by the previous passage of calculi. Strictures may also be congenital, and we find in the literature several descriptions of congenital stric-



FIG. 4. Calculus in intramural portion.

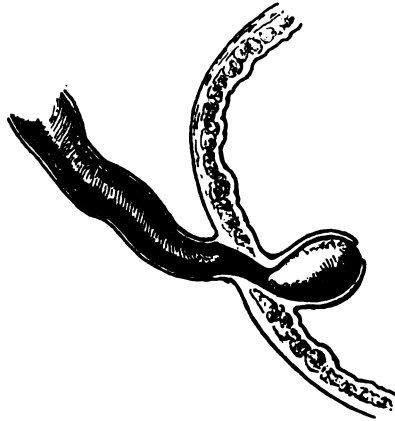


FIG. 5. Intravesical ureteral calculus.

ture, especially at the orifice. Besides hindering the passage of calculi, the dilation of the ureter just above the point of stricture is of itself a fertile field for the development of calculus.

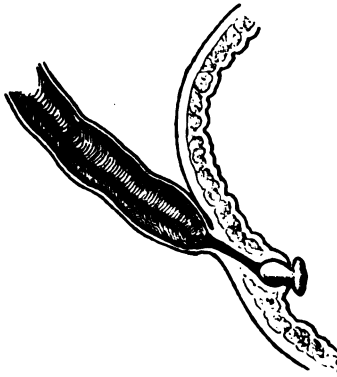


FIG. 6. Intravesical ureteral calculus.

About two years ago I discovered, in the course of a cystoscopic examination, a tight stricture of the orifice of the left ureter, which

had led to a globular dilation of the intramural portion of the ureter above. In this case, with each jet of urine, there sprang out a small rounded intravesical tumor, only to vanish as soon as the peristaltic ejection of the urine had ceased.¹² Such a condition must often lead to a stone formation of the intravesical type.

The extravescical causes of the ureteral narrowing and stricture are many, such as the pressure of tumors and inflammation of adjacent structures, with subsequent cicatricial contraction, which sometimes lead to sharp kinks in the ureter. The latter, being particularly common in women, explains the greater frequency of calculus of that portion of the ureter in females.

DIAGNOSIS.—There seem to be few, if any, symptoms of decided value in determining what position a stone occupies in the ureter, whether high up or low down. In both you may or may not get the classical symptoms of renal calculus. In one of my cases in which the stone was caught in the orifice of the ureter, the patient suffered severely with vesical irritation and pain running down to the end of the penis, associated with frequent micturition. Where the stone thus projects into the bladder we would expect to get the symptoms of vesical calculus, as well as ureteral, and in Case II, which I have reported above, in which the stone was intramural or juxtavesical, there was a pain in the bladder and penis. The cases in the literature, however, do not show that this is always the case, though the histories may not be accurate on that point. Between attacks the pain may entirely disappear, or evince itself as a dull ache in the region of the base of the bladder or back of the symphysis pubis. On account of the proximity of the vas deferens as it winds over the end of the ureter, it seems strange that testicular symptoms are so peculiarly infrequent, especially in the juxtavesical impactions.

Physical examination is often of little help. When the stone is below the brim of the pelvis, the characteristic tender point on abdominal palpation, which often indicates the point of impaction of calculi higher up in the ureter, is absent.

Rectal examination will, however, often show the location of the calculus. In fourteen cases of Israel, in which calculi were located in the pelvic section of the ureter, they were felt by rectal or vaginal examination in seven cases, and Israel is of the opinion that if examinations are made carefully and frequently, the stone should always be felt on bimanual (rectal and abdominal) examination, except in fat subjects. In only one of my cases did the rectal examination give any indication of the presence of stone.

The cystoscope of Nitze is of great value, for we nearly always find more or less extensive changes in the ureteral papilla on the

affected side. When the stone is not immediately in the lower end, *e. g.*, in the para-ischial or parasacral positions, we may only find a slight hyperemia and swelling around the orifice of the ureter. Intermittent spurts of turbid urine may however be seen. When the stone is in the juxtavesical position one generally sees a bulging of the wall of the bladder above or at the ureteral orifice, and the same is true when the stone is impacted in the intramural section of the ureter. When the stone is intravesical, it may be completely covered by mucous membrane as in the two cases of Newman, where the operator made the diagnosis of pedunculated intravesical fibroma. In these cases the orifice of the ureter could not be seen. When the stone projects through the lumen of the ureter it will of course be evident through the cystoscope, as in one of my cases. The catheterizing cystoscope is also of great value. By means of it the distance of the stone from the ureteral orifice can generally be determined. A stricture may also be detected, and in some cases dilated by means of the catheters and bougies. Its greatest value, however, is the possibility it furnishes of accurately determining the condition of the kidneys—especially the opposite one.

Recent advancements in clinical laboratory methods have placed at our disposal several valuable tests by which we can accurately gauge and compare the functional value of the two kidneys. With the determination of the urea, the freezing points of the two separate urines and the relative elimination of sugar by the kidneys after hypodermic injections of phloridzin, we are prepared to accurately determine the value of each kidney, the chances of unsuspected calculus on the opposite side and foresee the danger of postoperative suppression of urine.

The frequent report of deaths caused by taking out the only kidney, or where the remaining organ was atrophied; destroyed by cystic, hydronephrotic or pyonephritic changes or blocked by an unsuspected calculus, would not be found were the ureteral cystoscope more frequently employed.

Of great value also is the X-ray, and the medical profession owes a very great debt to Philadelphia for the splendid service which has been rendered by Charles Lester Leonard, in showing that ureteral calculi can be detected at all times, wherever located and however small. It has been of great assistance in my cases, and no examination can be complete without it.

There are, of course, slight chances of error. For instance a phlebolith of the veins of the pelvis or in the region of the seminal vesicles, where they are so commonly seen, might be mistaken for ureteral calculi, especially in those cases of chronic prostatitis asso-

ciated with slight hematuria. I have seen one such case, but the cystoscope showed that we had no ureteral trouble.

But a good radiograph should always be obtained, though we should not in our zeal take too many, as I have seen several very disagreeable burns result therefrom. With careful history, vigorous, repeated, bimanual rectal examinations, the radiograph and the cystoscope, the diagnosis of calculus, its location and the relative condition of the kidneys, is easy and certain, and we are now in a position to decide upon therapeutics.

THE THERAPEUTIC INDICATIONS are so manifold, and I have already consumed so much time that I can only give a mere outline of the results of this study of the question.

The treatment indicated depends on a multitude of things; the age, history and duration of the disease, the frequency and character of the attacks, the condition of the patient, and above all the question of what the effects have been on the kidneys.

The frequency with which calculi are passed one or more times, with no subsequent recurrence is sufficient to prove the value of a waiting policy. One of the cases which I have detailed, has almost certainly passed a small calculus which was located at the vesical juncture of the ureter.

Leonard's recent article in *American Medicine*, November 30, 1901, covers the subject very well. Leonard shows that small calculi may remain impacted for life in the ureter without producing symptoms or interfering with the function of the kidneys. They may, however, remain quiescent but destroy the kidney, which after fruitless attacks of colic may finally cease to secrete urine and gradually atrophy (as in the photograph of one of my specimens—Fig. 7), without producing any further symptoms; the other kidney assuming the entire work. If now the second kidney becomes blocked by a stone the chances of the fatal anuria and death after operation are great.

This should lead, as Leonard suggests, to frequent X-ray examinations to determine what is going on, and I should add, to accurate determination of what was happening to the kidney by ureter catheterization. If the kidney is not functioning, operation should be performed to remove the calculus, regardless of symptoms.

When the attack is severe, if suppression of urine or sepsis has set in, operation should, of course, be immediate. In some cases ureteral stones have been crushed between the fingers in the vagina, and Rovsing reports a case in the male in which the calculus was caused to be evacuated by abdominal massage along the ureter and by vigorously shaking the patient. When it is projecting from the end of the

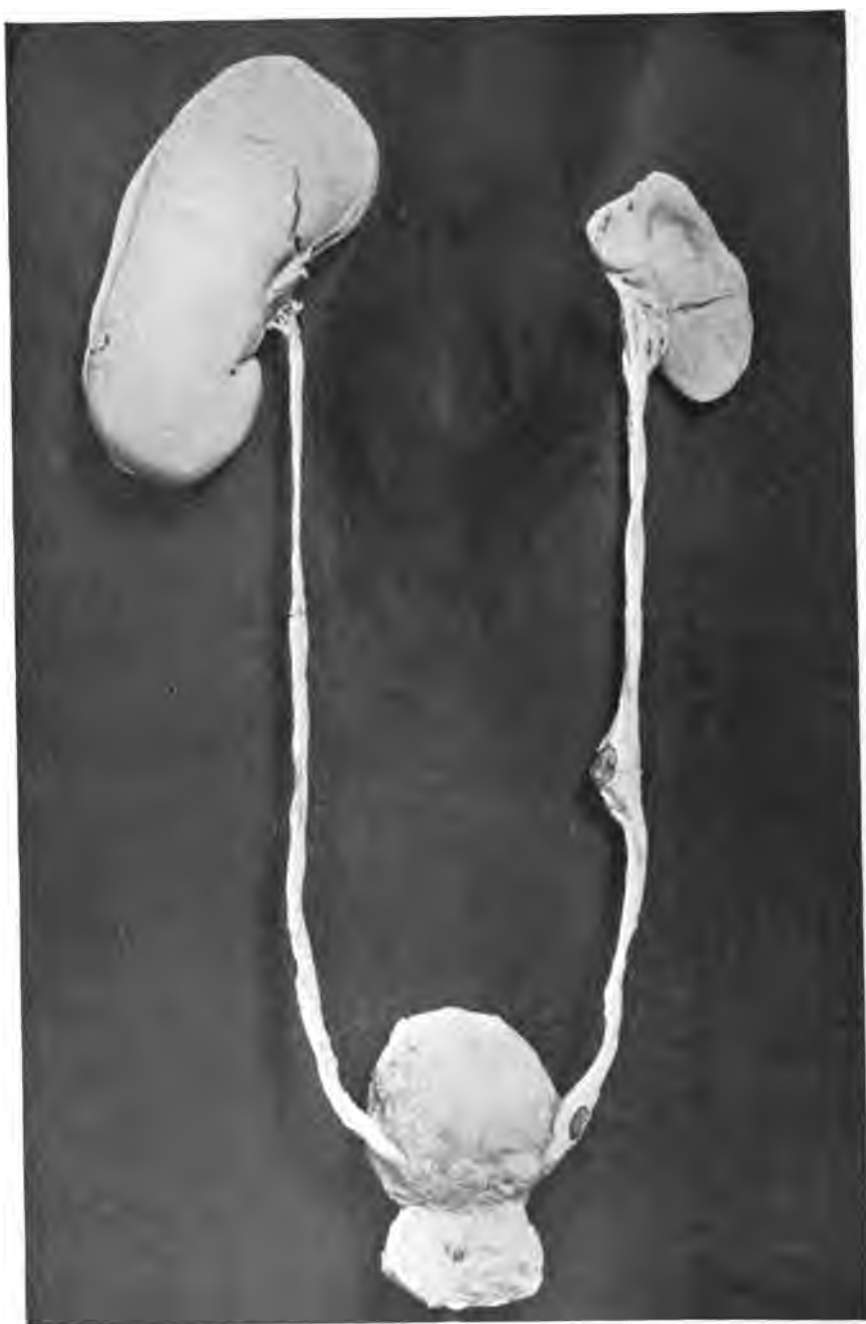


FIG. 7.

ureter into the bladder it may in rare instances be extracted by means of a ureteral catheter as in the case which I have reported. In my case this was quite easily accomplished by lateral pressure with the catheter, directed by the view through the male cystoscope. But this calculus was small.

Cystoscopic dilation of the lower end of the ureter to make room for the escape of a calculus has been successful in three cases in the male. I failed in my case. It might be more successful if done through a suprapubic opening, as Leonard suggests. When the stone is intra-vesical it can be most satisfactorily removed in the male through a suprapubic incision, and in some cases it may not be dangerous to incise the bladder wall to extract a calculus lodged in the intramural or juxtavesical portion of the ureter, but Thornton did this, produced a fistula into the peritoneal cavity and lost his patient. The peritoneum often runs down to the junction of the ureter and the bladder and between them, and incision or dilation for stone in that location seems a very dangerous procedure.

The iliac extraperitoneal route is safer and to be preferred for many reasons. When the stone is above the intramural portion, it is entirely out of reach from the bladder, and we have to decide between the several routes advised by different operators, viz: The perineal or prerectal, the intrarectal, the pararectal, the sacral, the intraperitoneal and the extraperitoneal or iliac route.

As we have seen above, the pararectal, the sacral and the intraperitoneal have not as yet been employed in the male, and the perineal or prerectal and the intrarectal only once each, with fatal results in the latter.

On the other hand, the iliac extraperitoneal route has been used seven times with two deaths, and neither attributed to the operation.

The evident difficulty of the perineal and parasacral routes, the great distance necessary to go to reach the ureter, the inability to explore the ureter or kidney above, or to determine accurately the presence of stricture below, and the inability to attack the higher tract without another operation seem to be sufficient to condemn all the inferior routes.

Stricture of the ureter, in my opinion, plays a great part in the production of calculi, in determining their point of impaction, and in leading to their recurrence. After the removal of a calculus a careful search should be always made for stricture below and ureteral bougies or probes should be made to pass freely into the vesical cavity from above. If this does not succeed, the milking process, which I employed, to see if the fluid can be emptied into the bladder may be tried. If all attempts fail a stricture is probably present and should be

cut if it cannot be dilated, and if situated at the vesical orifice it is a very simple matter to do an intravesical ureterotomy after opening the bladder through lateral incision (without a new abdominal incision). In my case the result is good and the cystoscope shows that the stricture may not be reformed.

The question of destroying the valve-like mechanism of the ureter is of course to be thought of, and in cases in which the kidney above is healthy and the bladder infected, the operation may be contra-indicated.

The only operative route through which the kidney can be explored, removed if necessary and stricture of the ureter treated is the iliac extraperitoneal. For this and many other reasons it should be the method of choice in all cases in which the stone is not distinctly intravesical or intramural. For calculi in the juxtavesical, and para-ischial regions of the ureter, it is distinctly better in every way than the inferior routes, in front of or beside the rectum, and for calculi in the parasacral and iliac portions it is the only practical route.

The lower portion of the ureter in the male, which was supposed only a few years ago to be beyond the reach of the surgeon, has also succumbed to the persistency and boldness characteristic of the age, and is now found to be as amenable to treatment as any other portion of the urinary tract.

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DISCUSSION.

DR. ORVILLE HORWITZ said that in the majority of cases in which a stone left the pelvis of the kidney it reached the bladder without doing any more harm than giving rise to a few hours of renal colic. Impaction seemed to be more common in the female than in the male; as an analysis of 47 cases showed 27 to have occurred in women, 18 in men; in 2 instances the sex was not stated. Calculi may become lodged in any portion of the canal, but are most commonly found in one of three situations: from one to 2 cm. below the beginning of the ureter; where the canal crosses the brim of the pelvis and at the point where it enters the bladder wall. From an examination of 12 cases reported,

in the 50th volume of the *Transactions of the Pathological Society of London*, it would appear as if the lodgment of stone in the ureter is most commonly found in the vicinity of the vesical end. In 3 the stone was found impacted in the upper; in 7 in the vesical, and in 2 instances the lower ends of both ureters were obstructed. A case similar to the latter condition has been reported by Dr. Eugene Fuller, of New York. In 44 cases Morris found that in 19 the stone was within 2 inches of the kidney; 11 in the vicinity of the brim of the pelvis; and 15 at the vesical end. Out of the 15 cases in which the stone was situated in the lower end of the canal, 12 were females. Dr. Horwitz's personal experience with impacted stone in the ureter is limited to 5 cases. In one instance the symptoms were those of stone in the kidney. An X-ray picture apparently located the calculus in the pelvis of the organ. At the operation the stone was detected lodged in the upper portion of the ureter just outside of the hilum. It was removed by means of a pyelotomy. In another case all the symptoms of obstruction of the ureter had existed for a long time, associated with pain, and a marked swelling of the affected side. An abscess formed in the lumbar region which ruptured, permitting the escape of a large amount of pus and urine, which relieved the aggravating symptoms from which the patient suffered. A fistula formed, which would occasionally close, giving rise to a recurrence of the pain and swelling. As soon as the sinus was re-established, the symptoms would disappear. An X-ray picture showed a stone impacted in the right ureter just below the brim of the pelvis. Operative interference was not permitted. The third case was that of a man, 70 years of age, very much debilitated and broken in health. An examination revealed a large stone in the left kidney, and obstruction of the lower end of the right ureter from an impacted calculus. No operation was permitted, and the patient was lost sight of. In the 2 remaining cases the calculi were found lodged in the lower end of the vesical outlet and removed by means of a suprapubic cystotomy. Regarding diagnosis, Dr. Horwitz said that catheterism of the ureters is of great value, and should always be attempted. It is oftentimes very difficult, if not impossible to accomplish; especially in those cases in which some pathological condition exists; the very class of patients in which it is most essential to obtain definite information regarding the condition of the ureters and kidneys. Catheterism of the ureters, through a suprapubic opening as suggested by Dr. Young, is usually difficult, unless the method suggested by Dr. Tilden Brown is adopted. This method consists in first passing the ureteral catheters through the urethra into the bladder. A cylindrical speculum is then inserted in the opening in the bladder and the end of the catheter grasped by means of a long slender forceps, and thus guided into the orifice of the ureter. When catheterism of the ureter is unsuccessful, the Harris segregator is the next instrument of choice. The X-ray is of inestimable value in helping to clear up an obscure diagnosis in cases of stone, but unfortunately it cannot always be relied upon. The speaker has operated upon 3 cases in which the X-ray pictures had been taken by well-known experts, which apparently showed the presence of stones in the kidneys, yet in opening the organs none could be found. In 2 instances the X-ray pictures were negative; the symptoms, however, being urgent, operation was determined upon and the stones found and removed. The value of

cryoscopy, the employment of methylene blue or phloridzin, alluded to by Dr. Young, in order to determine the renal insufficiency is still undetermined. It has been shown that a temporary diminution of the renal function is not of much consequence; moreover, normal reactions are sometimes obtained in cases in which a diseased condition of the kidneys exist. Other disorders, besides renal disease, may cause changes in the urine. In a recent article in the *Berliner klinische Wochenschrift*, Kiss goes over this subject very thoroughly and is skeptical as to its value. The incision recommended for reaching the upper end of the ureter began half an inch below the twelfth rib and parallel to it beginning from the anterior edge of the sacrolumbar muscle and extending to the tip of the rib. In order to reach the abdominal portion of the canal, it was advised that the cut should be continued downward to within half an inch of Poupart's ligament. In order to expose the vesical end, the "Duval incision" was thought to be the most satisfactory. Dr. Horwitz, while assistant to the late Prof. S. W. Gross, had an opportunity of witnessing an operation in which the stone was removed in this manner. An incision was made 5 inches in length from a point slightly above and one-quarter of an inch external to the pubic spine to about the middle of Poupart's ligament. From this point it was carried directly upward perpendicular to the ligament. The fascia and muscles were divided down to the peritoneum, which was then carefully stripped by means of the finger until the ureter was reached. The position of the stone can usually be detected by palpation.

DR. W. L. RODMAN said that his experience in ureteral calculus had been limited to one case. In this instance the condition had been diagnosticated stone in the bladder. He believes that many of the cases formerly diagnosed encysted stone were really ureteral calculi that had not passed into the bladder. In diagnosis Dr. Rodman agreed fully with both Dr. Young and Dr. Horwitz concerning the utility of the X-rays. Catheterization of the ureter in the male could be done by few men. Of the many routes by which the ureter may be reached, he believed that probably only 2 would live. The suprapubic route will undoubtedly be available in some instances; but the transperitoneal method he thought should be condemned. Should Dr. Rodman, after opening the abdomen discover a calculus in the ureter, he would close the wound, turn the patient over, and enter by the lumbar or iliac route. The danger of infection would be so great that he would be deterred from operating through the abdomen.

DR. CHARLES L. LEONARD said that he had examined 226 cases of suspected calculus in 67 of which calculi had been found, and 43 of these were ureteral. In reference to the frequency of calculi in the kidney and ureter in the male and female he gave the following statistics: 17 cases of calculus of the kidney in the male; 6 in the right and 11 in the left. Twenty-nine cases of calculus in the ureter; 12 in the right and 17 in the left. In the female 8 cases of calculus in the kidney; one in the right, 2 in the left and 5 bilateral. In the female, 13 calculi in the ureters; 3 in the right and 10 in the left. It was shown that the calculi predominate in the left ureter and in the left kidney. He had found multiple ureteral calculi in 4 cases; bilateral ureteral calculi in two cases and bilateral renal calculi in 8 cases. Dr. Leonard emphasized the fact that in diagnosis it is possible by the X-rays to determine the

size and position of the calculi. From the examination mentioned by Dr. Young of the ureters and the condition of the urine, it can be determined whether the kidneys are performing their functions, and a study of the symptomatology will show whether it is possible for the calculus to pass. In 10 cases Dr. Leonard had suggested to the attending surgeon that medical treatment was safe; that delay in operation might result in the passage of the calculus. The suggestion had been followed out and the calculi had been passed in all of the 10 cases. Other cases in which the same treatment had been suggested the calculi had not yet passed. Unless the symptoms become acute, Dr. Leonard saw no reason why the passage of the calculus should not be awaited. Since the localization of the calculus can be determined it is now unnecessary to open the kidney and explore the ureter to find it, and if the symptoms become acute immediate operation can be done. Dr. Leonard cited one case in which the calculus was found to be an inch below the lower pole of the kidney, and in which it was cut down upon and removed without exploration of the kidney. In many cases it is possible from the outline to determine the position of the calculus. Dr. Leonard had seen cases in which, through an incision admitting the little finger, the calculus could be removed without further trauma to the kidney. This, it was stated, is a great saving in the reparative power of the kidney, as well as lessening of the danger of lumbar fistula. Two cases were mentioned in which operation for stone in the kidney had been done in which no stone was found and which had been followed by fistula. In these cases the skiagraphic examination showed the calculus lower down in the ureter whence it was subsequently removed. Dr. Leonard laid special emphasis upon the fact that it is rational with the exact knowledge which the X-rays give, to wait for the passage of the calculus rather than to resort to an operation that is hazardous. In the cases reported by Dr. Young, and those in which the impaction is low down in the ureter, the necessity of operation is greater. He agreed entirely with Dr. Rodman regarding encysted calculi. He had seen cases of large calculi believed to be in the bladder, but which he felt were encysted in the ureter. Such cases would produce symptoms like those of calculus in the bladder.

Dr. YOUNG, in closing, said that catheterization is not always necessary; for instance, when upon ordinary cystoscopic examination a pathological condition of the ureter is found. Inspection, without catheterization would reveal the side affected, and the calculus would probably be found lower down. While admitting that catheterization is sometimes difficult, in the majority of cases Dr. Young thought that a little trouble would yield success. It is important that the condition of the other kidney should be ascertained and, as a rule, this is easy to catheterize, and its functional value should be determined before operation. A modified catheter was shown, by which it is easily possible to catheterize both ureters without any trauma and without giving the fluid in the bladder any chance to become cloudy. By this also, the danger of infection is slight. The X-ray picture, Dr. Young thought as necessary in most cases, as ureteral catheterization. Early in the disease, however, and with the patient in good health, the X-ray photograph might not be a necessity.

The Treatment of Suppuration in the Uterine Appendages.

BY CHARLES P. NOBLE, M. D.

[Read March 12.]

The treatment of pelvic suppuration in women is a subject which has been so much discussed during the past twenty years that one might well hesitate to bring it before you. My reason for doing so is that although the subject is old as a basis for discussion, it is one of the most important in gynecology. It is my purpose to report my entire experience in dealing with the various varieties of suppuration in the uterine appendages, to give the results which have been secured by the several operations which have been practised, and to present the conclusions which I have drawn from this experience as a basis for discussion.

Cases of suppuration in the female pelvis can be advantageously divided into two classes: Circumscribed abscesses, as represented by pyosalpinx, abscess of the ovary and puerperal phlegmon; and intra-peritoneal collections of pus complicating suppurating disease of the uterine appendages. This report deals with 200 cases, 146 of which were treated by abdominal section, and fifty-four by incision and drainage, in almost all cases the avenue of approach being through the vagina.

Historically the operative procedures employed have passed through three periods of development. Prior to 1895 almost all patients were operated upon by abdominal section and the removal of the appendage or appendages involved. During this period drainage either with the glass tube or with gauze was freely resorted to. Later, when both appendages were involved, hysterectomy has been substituted in the great majority of cases for oophorosalphingectomy; and the employment of drainage has been more and more restricted, until it is now used only in the worst cases.

During the era of hysterectomy there has been a growing tendency, which has become a fixed rule, to avoid abdominal section in all cases of large pelvic abscess in which the disease of the uterine appendages is complicated by intraperitoneal abscess. Such patients are treated by incision and drainage. The good results, remote as well as immediate, secured by this method, have led to the extension of the indication for vaginal incision to circumscribed pus collections when these can be easily reached, especially when of long standing, or if the patient comes under observation during an acute attack.

Vaginal hysterectomy has not been employed in cases of pelvic

inflammation. The arguments of those claiming that this method offers advantages over the simple incision in the complicated cases, or over abdominal section in the typical cases of pelvic suppuration, have never seemed convincing.

The number of cases embraced in this report would be greater and the mortality would be higher if the cases of suppurating ovarian tumors and suppurating fibroids, with or without pyosalpinx as a complication, were included.

In looking back over fourteen years' work in this field it is gratifying to realize that our present methods give far better results, both immediate and remote, than those in use in the first half of this period. Prior to 1895 the mortality in fifty-five cases was 16.3 per cent.; since the beginning of 1895 the mortality in ninety-one cases has been 6.5 per cent. in patients treated by abdominal section. If to these are added fifty-four patients treated by incision and drainage, the mortality has been reduced to 4.8 per cent.

This very substantial reduction in mortality by no means represents the entire gain which has been secured by changes in technique. With the improvements in technique the necessity for abdominal drainage has been almost entirely eliminated. The avoidance of drainage and the employment of an improved technique in closing the abdominal wound have reduced the occurrence of postoperative hernia from upward of 10 per cent. to a fraction of 1 per cent. The substitution of sterile catgut ligatures for silk has eliminated the occurrence of pedicle ligature abscesses from the list of sequels, together with the adhesions and sinuses which formerly gave great annoyance in a not inconsiderable percentage of cases.

From the standpoint of the patient, one of the greatest gains has been in the marked lessening of the percentage suffering from post-operative pain from adhesions, inflammatory exudate and pedicle abscesses. This group of complications in former years was sufficiently common to substantially lessen the benefits otherwise secured from operation in pelvic inflammatory cases. At the present time such complications are rare, and cases requiring the reopening of the abdomen to relieve pain due to adhesions and pedicle abscesses have practically disappeared from practice.

In order to bring the subject before you in proper shape for discussion it will be best to consider *seriatim* operation in the various types of cases by the different methods under consideration.

Operation for Pyosalpinx or Abscess of the Ovary Complicated by Intraperitoneal Abscess.—Twenty-six patients belonging to this group have been operated upon, with seven deaths, or about 27 per cent. In four of these patients hysterectomy has been done, with

two deaths; and in twenty-one patients one or both uterine appendages have been removed, with five deaths. A mortality of 27 per cent. is too great to be accepted in any operation, if by any means it is possible to secure better results. For this reason simple drainage has been substituted for radical operation in this class of cases, with the result of reducing the primary mortality to less than 2 per cent. The ultimate result secured by this method will be discussed under its proper head.

Experience in operating upon this class of patients by the two methods has convinced me that the radical abdominal operation should be abandoned and simple drainage substituted. The objections to the radical abdominal operation, either the removal of the appendages or hysterectomy, are: First, the high primary mortality; and second, the numerous sequels which are apt to follow radical operation in this particular group. As the pus is not contained in an abscess sac it is impossible to remove the wall of the abscess, so that a pus-secreting membrane must be left within the peritoneal cavity, which necessitates the employment of drainage, and usually a large gauze drain. If drainage by the abdominal route is practised, the result in a large percentage of cases is postoperative hernia. Owing to the conditions present and the use of drainage, postoperative adhesions are inevitable, and in a considerable percentage of cases give rise to pain, and may require subsequent operation. Owing to the infiltration of the bowel, fecal fistula is a common complication of radical operation in this group of cases. If a radical operation is attempted for pyosalpinx complicated by intraperitoneal pus, especially during the course of an acute peritonitis, all of the pelvic organs are so infiltrated with inflammatory lymph that almost inevitably both appendages are removed. Especially in cases of abscess of puerperal origin, one or both appendages can be saved if a drainage operation instead of a radical operation is performed. Of the fourteen patients in whom a subsequent abdominal section was performed, out of the fifty-four patients in whom incision and drainage were practised, in only three was it necessary to remove both uterine appendages. For all these reasons the radical operation is to be condemned and simple drainage substituted.

To this change in practice more than to anything else is due the fact that the mortality from abdominal section in the entire group of pus cases has been reduced from 16.3 per cent. to 6.5 per cent. in the last seven years, as compared with the preceding seven; and that the mortality in the total number of cases in the last seven years has been reduced to 4.8 per cent.

When through an error in diagnosis the abdomen is opened in a patient belonging to this group, if conditions permit, it is best to abandon the abdominal operation and resort to vaginal drainage. To make this feasible it is necessary to have a well-trained assistant, who can keep himself clean and close up the abdomen after the drainage operation has been completed. If this is not feasible, it may be better simply to make drainage from above and leave the diseased tube or ovary for a subsequent radical operation rather than to attempt its removal when the patient is reduced by sepsis and fever, and when the entire pelvis is infiltrated with inflammatory exudate. The careful evacuation of the abscesses and a well-placed drain, protecting the general peritoneal cavity, will save a far larger percentage of such patients than a radical operation.

Operation for Pyosalpinx or Abscess of the Ovary, the Pus being Confined to the Tube or Ovary.—In this group of cases 120 patients have been operated upon, with eight deaths, or 6.6 per cent. Of these, forty-six have been operated upon by hysterectomy, with one death, a mortality of 2.1 per cent.; and seventy-four by the removal of one or both uterine appendages, with seven deaths, a mortality of 9.4 per cent. The reasons for the markedly better results secured by hysterectomy, as contrasted with those from the simple removal of the affected appendages, are easily understood by one who has practised both methods. To analyze these two groups of cases more closely: During the time that the forty-six hysterectomies were done, thirty-four patients have been operated upon with the removal of one or both appendages. In the patients in whom the uterus as well as the appendages were removed the mortality has been 2.1 per cent., and in those in whom one or both appendages were removed, leaving the uterus, the mortality has been 5.8 per cent. As the patients were operated upon during the same period of time it cannot be alleged that a growing operative experience is the explanation of the improved results in the hysterectomy cases. Moreover, as a matter of fact, the group of cases in which hysterectomy was done was of a more serious nature than that in which the appendages alone were removed, because whereas in the first group both appendages were involved in all cases, in the group of thirty-four cases in only half of them was it necessary to remove both appendages.

The conditions under which it is preferable to remove the appendages rather than to do a hysterectomy have usually to do with the anesthetization of the patient. Full anesthesia and quiet respiration are very desirable for the performance of hysterectomy, whereas the appendages can be removed with the patient only partly under the

anesthetic. When, as sometimes happens, it is difficult or dangerous to fully anesthetize a patient, this fact may decide the choice against hysterectomy.

The manifest advantages of hysterectomy over oophorosalphingectomy are: (1) Hemorrhage is better controlled, as the main trunks of the ovarian and uterine arteries are ligated. This very greatly lessens the tendency to oozing hemorrhage from torn adhesions. (2) The pelvis is left in a very much more healthy condition, because the peritoneum from the anterior face of the broad ligaments and the bladder peritoneum, which is almost invariably normal, can be drawn over and sutured upon the raw areas upon the posterior surfaces of the broad ligaments and floor of the pelvis. Such raw surfaces are inevitable, because of the separation of the diseased appendages. A much better inspection of the pelvis is afforded at this stage of a hysterectomy than is possible at the conclusion of an oophorosalphingectomy; and isolated oozing points may be ligated, in this way avoiding postoperative collections of blood in the pelvis. By leaving the pelvis in better condition the occurrence of postoperative inflammation, masses of exudate and blood accumulations are much less common after hysterectomy than after oophorosalphingectomy.

In the group of cases of pyosalpinx and abscess of the ovary prior to 1895 drainage was employed in the great majority of cases, even though the pus sac was not ruptured in its removal. This was done on the ground that the case was suspicious from the standpoint of infection, and that the drainage was of service in removing blood from the torn adhesions. At the present time drainage is practically never employed in such cases, even though the pus sac is ruptured in its removal. Drainage is indicated only when the integrity of the bowel, bladder or ureter is open to suspicion, and in very rare cases in which the condition of the patient makes the arrest of oozing hemorrhage from minute bleeding vessels hazardous because of the time consumed. The last indication is very rare in good hands. The ground on which drainage is omitted when pus sacs are ruptured is that if the peritoneum is left in a fairly normal condition it is better able to resist infection without than with drainage.

Incision and Drainage for Pyosalpinx and Abscess of the Ovary when Complicated by Acute Peritonitis, or by Intraperitoneal Abscess. Incision and Drainage for Puerperal Phlegmon.—The relatively high mortality of abdominal section for complicated cases of suppuration in the uterine appendages has led to the employment of simple incision and drainage. This might be considered a reversion to the type of operation in vogue before the introduction of abdominal section for

the cure of inflammatory disease of the uterine appendages. But this is only partly true. The old operation of aspiration and puncture for pelvic abscess was practised without an adequate knowledge of the pathology of pelvic suppuration, and the technique employed was so imperfect as to yield very poor results. Incision and drainage at the present time is practised with a full knowledge of the pathology of pelvic suppuration, and enlightened by this knowledge the surgeon is enabled to vary his technique so as to meet the indications for the thorough evacuation and drainage of the pus cavities in the different classes of cases presenting themselves.

Incision and drainage has been practised in fifty-four patients. In the great majority of the patients the incision has been made through the vault of the vagina, in a small number through the groin, and in some by a combination of the two incisions. The results obtained, as nearly as can be ascertained, are: Thirty-two have been cured, in fifteen there has been a partial failure, in six the ultimate result is unknown—that is, the patients have disappeared from observation—and in one case the patient died of heart clot immediately after operation. This patient was almost moribund when operated upon. By cured is meant that the patient has been restored to good health and no further operation has been required. By failure is meant that a subsequent operation for the removal of one or more of the appendages has been required. Most of these so-called failures have been in a very real sense brilliant successes, as the lives of the patients have been saved when in jeopardy and a cure has been made possible by subsequent abdominal section. In fourteen patients in whom a radical operation was performed at a subsequent date all made good recoveries from the secondary abdominal section, and in only three of them was it necessary to remove both appendages. Fourteen patients required a subsequent abdominal section as follows: Hysterorrhaphy, one; unilateral oophorosalphingectomy with hysterorrhaphy, one; unilateral oophorosalphingectomy, eight; hysterectomy, three; ventral herniotomy, one. The inclusion of eight of the fifty-four patients operated upon by incision and drainage for pus may be questioned, as pus was not evacuated by the incision. These cases are as follows: Postoperative exudate, no pus, four; ectopic pregnancy, no pus—acute nephritis, one; hematocele, no pus—associated with cancer and phlebitis, one; puerperal cellulitis, no pus, two. These facts are strong arguments in favor of simple incision in complicated pus cases, as the radical operation performed as a primary procedure would have had a very different mortality—not to speak of the thirty-two patients cured by the incision alone—and most of the patients would have lost both appendages.

The following is an analysis of the fifty-four cases in which the patients were treated by incision and drainage:

Diagnosis.	Cases.	Cured.	Failed.	Unknown.	Died.
Postoperative exudate and inflammatory cyst	4	2	0	2	0
Ectopic pregnancy	1	0	1	0	0
Suppurating ectopic pregnancy	3	2	1	0	0
Suppurating ovarian cyst	2	0	2	0	0
Unclassified, including 11 pelvic abscesses					
of undetermined origin	13	5	4	4	0
Puerperal abscess and cellulitis	22	15	6	0	1
Gonorrheal pelvic abscess	9	8	1	0	0

Of the cases of hematocele from ectopic pregnancy, in three sup-
puration was undoubted, and in one doubtful. In the doubtful case
vaginal incision was practised because of acute nephritis. Of the four
cases it was subsequently necessary to perform a radical abdominal
operation in two, or 50 per cent. In one case a hydrosalpinx had
developed, and in the other a tubal mole. This result is of interest
as bearing upon the general question of the treatment of hematocele
from ectopic pregnancy. The radical abdominal operation yields such
uniformly good results in cases of hematocele as to make vaginal
incision of doubtful value except in cases in which suppuration has
occurred.

In the two cases of suppurating ovarian cyst treated by vaginal
incision and drainage, failure resulted. From the nature of the case
this result was to be expected. Simple incision is indicated in such
cases only when the condition of the patient forbids a resort to the
radical operation.

The unclassified cases consisted largely of abscesses in which it
was difficult to determine whether they were of gonorrheal or of puer-
peral origin.

Of the twenty-two cases of puerperal abscess and cellulitis, fifteen
patients were cured; in six the operation was a failure, and one patient
died. Two of the failures were counted twice, as each patient was
operated upon once at home and once in the hospital. Puerperal
phlegmon and puerperal ovarian abscess offer the best field for incision
and drainage. A perfect cure can be effected in all such cases, with
the preservation of all the organs of generation. This is also true of
most cases of puerperal intraperitoneal abscesses, and many cases of
acute puerperal suppurating salpingitis. Increasing experience
strengthens the conviction that incision and drainage is the opera-
tion of election for puerperal abscesses, and that abdominal section
should be employed only in very exceptional cases.

Of the nine cases of gonorrheal abscess eight patients were cured, and one was a failure. This would indicate that the results of simple incision were better in gonorrheal cases than in any other class. This apparent showing I believe to be fallacious. It has been, and is my belief, that recent gonorrheal pus tubes should not be operated upon by incision and drainage, for two reasons: First, that if operated upon the good results would only be temporary in character; and second, that radical operation gives excellent results in these cases, as it is well recognized that gonorrheal pus seldom gives rise to post-operative peritonitis. Therefore, of the nine cases of gonorrheal pelvic abscess, eight were cases of long standing; and so far as a limited number can, these cases show that good results can be obtained by incision and drainage in long-standing cases of gonorrheal pyosalpinx and intraperitoneal abscess, but they have no bearing upon the question of incision and drainage in recent gonorrheal cases.

The following are the conclusions which I have drawn from the experience of operations in 200 cases of pelvic suppuration in women, and from a study of the results obtained. These are presented for discussion:

The methods of dealing with suppuration of the uterine appendages have been greatly improved within the past fourteen years. The mortality has been reduced from more than 16 per cent. in the first half of this period to less than 5 per cent. in the second half.

This reduction in the mortality has been obtained by: (1) Abandoning abdominal section in the treatment of pyosalpinx and abscess of the ovary when complicated by intraperitoneal abscess, and by substituting direct incision and drainage in this group of cases, and also for recent cases of pelvic suppuration of puerperal origin. (2) By substituting hysterectomy for oophorosalphingectomy for the removal of bilateral suppuration in the uterine appendages.

These changes in methods of operation have permitted the development of a much more perfect technique, which yields greatly improved results, remote as well as immediate. Ventral hernias, pedicle abscesses and troublesome intraperitoneal adhesions have become very rare instead of very frequent sequels of abdominal operations.

Free incision and drainage in cases of suppuration of the uterine appendages complicated by intraperitoneal abscess has proved to be a most valuable life-saving measure, yielding a mortality of less than 2 per cent., as contrasted with 27 per cent., from abdominal section. The remote results have been scarcely less gratifying, thirty-two of the fifty-four having been permanently cured.

Incision and drainage has proved to be a most conservative operation, not only in the saving of life, but in the conservation of the sexual

organs. Of the fourteen patients in whom subsequently a radical abdominal operation was performed, in only three was it necessary to remove more than one uterine appendage. The substitution of incision for the radical operation has saved many young women from the annoyance of a premature menopause, and has enabled a number of them to bear children. Six pregnancies are known to have occurred, resulting in five children—one pair of twins, one miscarriage and one pregnancy now developing.

Direct incision and drainage finds its best indication in: (1) puerperal phlegmon; (2) puerperal ovarian abscess, intraperitoneal abscess and pyosalpinx; (3) in complicated cases of pelvic suppuration of whatever origin, in which the pus is not contained within the ovary and tube.

The value of direct incision is most manifest in the worst class of cases, in which the patient is acutely ill from suppuration and peritonitis, and in which abdominal section gives its worst results.

Finally, I wish to acknowledge my indebtedness to Drs. W. S. Crosby, Ellice McDonald and Stephen E. Tracy, who have compiled the elaborate tables necessary for the preparation of this paper; and also to the family physicians who have kindly answered inquiries as to the present status of many of the patients.

VAGINAL INCISION AND DRAINAGE FOR PELVIC SUPPURATION—OUTSIDE CASES.

Mrs. McN., June 18, 1895. Family physician, W. D. Robinson. Diagnosis, pelvic abscess following dilation and injection of hydrogen peroxide. Operation, vaginal incision and drainage. Recovered. Subsequent history, is entirely well. December 6, 1901.

Miss K., January 28, 1896. Family physician, Franklin Brady. Diagnosis, gonorrheal pelvic abscess from long-standing pus tubes; peritonitis; acute sepsis. Operation, vaginal incision and drainage. Recovered. Subsequent history, has continued well and has been able to do hard work. December 1, 1901.

Mrs. R., February 23, 1896. Family physician, J. T. Walker. Diagnosis, puerperal abscess. Operation, incision left groin and vaginal incision. Recovered. Subsequent history, has remained well. December 10, 1901.

Mrs. B., February 26, 1896. Family physician, W. D. Robinson. Diagnosis, puerperal pelvic abscess, intraperitoneal, about brim of pelvis. Operation, vaginal incision and drainage. Recovered. Subsequent history, pelvic organs normal, has had one child since. December 6, 1901.

Miss H., December 31, 1896. Family physician, B. F. Hawley. Diagnosis, gonorrheal pelvic abscess; almost moribund from peritonitis and sepsis. Operation, vaginal incision and drainage. Recovered. Subsequent history, felt well, but had adherent appendages when last seen; is married; sterile.

Miss F., October 5, 1898. Family physician, J. C. Cooper. Diagnosis, gonorrheal pelvic abscess. Operation, vaginal incision and drainage. Recov-

ered. Subsequent history, has continued well; is married; no children. December 5, 1901.

Mrs. S., February 6, 1899. Family physician, Mary H. Cheney. Diagnosis, suppurating hematocele; ectopic pregnancy. Operation, vaginal incision and drainage. Recovered. Subsequent history, right hydrosalpinx developed; abdominal section, unilateral salpingo-oophorectomy May 3, 1899. Is well.

Mrs. R., March 5, 1899. Family physicians, W. E. Hall and J. H. Pugh. Diagnosis, puerperal pelvic abscess. Operation, vaginal incision and drainage. Died of heart clot shortly after operation.

Miss H., October 27, 1899. Family physician, I. Leopold. Diagnosis, puerperal pelvic abscess opening into rectum. Operation, vaginal incision and drainage. Recovered; secondary hemorrhage. Subsequent history, sinus; second operation in hospital, March 3, 1900. Sinus remains.

Mrs. L., November 25, 1899. Family physician, J. H. Pugh. Diagnosis, recent puerperal pyosalpinx, pelvic abscess and fibroids. Operation, vaginal incision and drainage. Recovered, but not cured. Subsequent history, sinus persisted; second incision January 18, 1900, and later abdominal section to remove right appendage.

Mrs. A., December 14, 1899. Family physician, G. H. West. Diagnosis, pelvic gonorrheal abscess; sick for 20 years. Operation, vaginal incision and drainage. Recovered. Subsequent history, continued to do well, excepting painful menstruation. December 15, 1901.

Mrs. S., December 15, 1899. Family physician, J. C. Cooper. Diagnosis, pelvic abscess. Operation, vaginal incision and drainage. Recovered. Subsequent history, involved right appendage removed by celiotomy, February 5, 1900. Left appendage removed for ectopic pregnancy, May 17, 1901.

Mrs. S., January 21, 1900. Family physician, Helen Kirshbaum. Diagnosis, puerperal pelvic abscess. Operation, vaginal incision and drainage. Recovered. Made good recovery; since delivered of a child.

Miss S., January 24, 1900. Family physician, I. Leopold. Diagnosis, recent gonorrheal pyosalpinx and abscess. Operation, vaginal incision and drainage. Recovered. Subsequent history, is married and well; has not been pregnant. December 4, 1901.

Mrs. P., May 19, 1900. Family physician, Ellwood Patrick. Diagnosis, puerperal pyosalpinx and abscess, postabortum. Operation, vaginal incision and drainage. Recovered. Subsequent history, second abscess pocket opened June 14; has improved until now has entirely recovered her strength. Has had one attack of peritonitis; requires a radical operation. December 13, 1901.

Mrs. M., June 15, 1900. Family physician, Ellwood Patrick. Diagnosis, puerperal pyosalpinx and abscess, postabortum. Operation, vaginal incision and drainage. Recovered. Subsequent history, has since enjoyed good health. December 13, 1901.

Mrs. H., October 4, 1900. Family physician, H. Jarrett. Diagnosis, gonorrheal pelvic abscess. Operation, vaginal incision and drainage. Recovered. Subsequent history, made very good recovery and is entirely comfortable. December 10, 1901.

Mrs. R., January 31, 1901. Family physician, Joseph Bringham. Diagnosis, large pelvic abscess, gonorrheal; acute sepsis, patient very ill. Operation, vaginal incision and drainage. Recovered. Subsequent history, second pocket opened by vaginal incision 4 weeks later, fecal fistula developed; December 5, 1901, is quite well and strong, without pelvic discomfort; tiny fistula, through which gas but no fecal matter escapes, is still present.

Mrs. A., May 1, 1901. Family physician, Edward Kerr. Diagnosis, puerperal phlebitis and cellulitis of right broad ligament; operation 34 days after labor. Operation, vaginal incision; perforation of the exudate, no pus found. Recovered. Subsequent history, has since remained well. December 10, 1901.

Mrs. G., May 19, 1901. Family physicians, Helen Kirshbaum and W. Wayne Babcock. Diagnosis, puerperal ovarian abscess. Operation, vaginal incision and drainage; mass consisting of suppurating ovary was freely movable, broad ligament but little infiltrated. Recovered. Subsequent history, made good recovery; appendage involved, is normal on examination; patient pregnant.

Mrs. J., June 3, 1901. Family physician, W. T. Sharpless. Diagnosis, pelvic abscess secondary to appendicitis. Operation, vaginal incision and drainage. Recovered. Subsequent history, made good recovery; pelvic organs normal in position and free from tenderness. November 2, 1901.

VAGINAL INCISION AND DRAINAGE FOR PELVIC SUPPURATION—HOSPITAL CASES.

Mrs. S., January 11, 1896. Family physician, C. R. Marshall. Diagnosis, suppurating ectopic pregnancy; sinus into vagina through which femur of fetus protruded. Operation, vaginal incision and drainage. Recovered. Subsequent history, has remained well. December 15, 1901.

Mrs. M. H., May 9, 1896. Diagnosis, double pyosalpinx; acute nephritis. Operation, vaginal incision and drainage. Recovered.

Mrs. I. S., December 7, 1896. Family physician, D. F. Greenewald. Diagnosis, suppurating ectopic pregnancy. Operation, vaginal incision and drainage. Recovered. Subsequent history, permanent recovery. December 15, 1901.

Mrs. B. R., March 11, 1897. Family physician, David Riesman. Diagnosis, puerperal cellulitis. Operation, vaginal incision into exudate; no pus. Recovered. Subsequent history, was well when last heard from. December 10, 1901.

Mrs. F. D., March 24, 1897. Family physician, Wm. E. Parke. Diagnosis, pelvic exudate following oophorosalphingectomy. Operation, vaginal incision into exudate; no pus. Recovered.

Mrs. F. L., April 3, 1897. Family physician, Wm. E. Parke. Diagnosis, mass in right broad ligament, from old pedicle abscess. Operation, vaginal incision and drainage. Recovered.

Mrs. B., May 8, 1897. Family physicians, Wm. N. Ferguson and Thos. E. Jones. Diagnosis, pelvic abscess behind left broad ligament; puerperal. Operation, vaginal incision and drainage. Recovered. Subsequent history, hysterorrhaphy a year later. Uterine appendages normal. Well June, 1901.

Mrs. F. J., October 27, 1897. Family physician, J. C. Brobst. Diagnosis, suppurating ovarian cyst. Operation, ischiorectal sinus incised and packed; vaginal incision and drainage. Recovered. Subsequent history, failure—sinus persisted. Secondary abdominal hysterectomy. Recovered.

Mrs. M. K., November 22, 1899. Family physician, C. R. Marshall. Diagnosis, suppurating ovarian cyst. Operation, vaginal incision; no pus reached. Recovered. Subsequent history, secondary abdominal section; hysterectomy; recovered.

Miss S. D., February 24, 1898. Family physician, Wm. N. Ferguson. Diagnosis, pelvic abscess (abortion); pint of pus. Operation, vaginal incision and drainage. Recovered. Subsequent history, made good recovery. January 6, 1902.

Mrs. J. G. P., March 23, 1898. Family physician, J. H. Ruhl. Diagnosis, postoperative inflammatory cyst. Operation, vaginal incision and drainage. Recovered. Subsequent history, good recovery.

Mrs. A. N., May 14, 1898. Family physician, Hannah M. Thompson. Diagnosis, pelvic abscess (abortion). Operation, vaginal incision and drainage. Recovered. Subsequent history, has remained well. January 15, 1902.

Mrs. U. P., December 17, 1898. Diagnosis, pelvic abscess, acute peritonitis. Operation, vaginal incision and drainage. Recovered.

Mrs. S., January 25, 1899. Family physician, Helen Kirshbaum. Diagnosis, pelvic abscess, extensive peritonitis; dermoid cyst. Operation, vaginal incision and drainage. Recovered. Subsequent history, subsequent celiotomy; oophorosalphingohysterectomy. Recovered.

Miss F. B., September 4, 1899. Diagnosis, pelvic abscess; postabortum. Operation, vaginal incision and drainage. Recovered. Subsequent history, good recovery. Well one year later.

Mrs. S. H., September 28, 1899. Diagnosis, pelvic abscess. Operation, vaginal incision and drainage. Recovered.

Mrs. E. L., January 18, 1900. Family physicians, W. E. Hall and J. W. Pugh. Diagnosis, pelvic abscess; postabortum. Operation, vaginal incision enlarged and drainage. Recovered. Subsequent history, failure—secondary unilateral oophorosalphingectomy. Well June, 1901.

Miss C. H., March 3, 1900. Family physician, Isaac Leopold. Diagnosis, pelvic abscess; postabortum. Operation, vaginal incision and drainage. Recovered. Subsequent history, sinus persists.

Miss A., March 21, 1900, March 26, 1900. Diagnosis, pus tubes; gonorrheal; pelvic abscess; acute peritonitis. Operation, vaginal incision and drainage. Recovered. Subsequent history, made good recovery after second incision.

Mrs. U. B., April 7, 1900. Family physician, L. Boyer. Diagnosis, postoperative exudate. Operation, vaginal incision and drainage. Recovered. Subsequent history, good recovery. December 15, 1901.

Mrs. M. G., October 6, 1900. Diagnosis, pelvic abscess. Operation, vaginal incision and drainage. Recovered.

Mrs. M. M., December 15, 1900. Family physician, T. E. Jones. Diagnosis, pelvic abscess (puerperal); acute peritonitis—sepsis; large amount of

pus. Operation, vaginal incision and drainage; second incision opposite side. Recovered. Subsequent history, health good. Increased weight. January 15, 1902.

Mrs. N., December 17, 1900. Family physician, J. J. Moylan. Diagnosis, right ectopic pregnancy; nephritis. Operation, vaginal incision and drainage; pack. Recovered. Subsequent history, abdominal section to remove tubal mole, June 8, 1901; oophorosalphingectomy. Made good recovery.

Mrs. I. H., December 20, 1900. Family physician, Isaac Leopold. Diagnosis, pelvic abscess. Operation, vaginal incision and drainage. Recovered. Subsequent history, reopened abscess. Good recovery.

Mrs. D., January 9, 1901. Family physician, G. Y. MacCracken. Diagnosis, pelvic hematocele associated with cancer and phlebitis. Operation, vaginal incision and drainage (gauze). Recovered. Subsequent history, good recovery.

Mrs. M. W., January 30, 1901. Family physician, J. A. Krug. Diagnosis, large pelvic abscess; septicemia. Operation, vaginal incision and drainage. Recovered. Subsequent history, August 15, needs radical operation.

Miss P. K., January 31, 1901. Diagnosis, tubo-ovarian abscess; acute peritonitis. Operation, vaginal incision and drainage. Recovered. Subsequent history, left oophorosalphingectomy and hysterorrhaphy. February 27, 1901.

Mrs. E. C., September 27, 1901. Family physician, J. H. Lowright. Diagnosis, large pelvic abscess; gonorrheal. Operation, vaginal incision and drainage (gauze). Recovered. Subsequent history, good recovery. February 15, 1902.

INCISION AND DRAINAGE THROUGH THE ABDOMINAL WALLS FOR PELVIC SUPPURATION.

Mrs. H., April 21, 1891. Family physician, I. Leopold. Diagnosis, puerperal phlegmon right broad ligament; extensive peritonitis. Operation, incision through right groin; drainage. Recovered. Subsequent history, October 27, 1892, was operated on for ventral hernia; abdominal and pelvic contents normal except slight adhesions; right ovary and tube normal. Delivered at term 18 months later.

Mrs. X., May 1, 1894. Family physician, Thos. D. Dunn. Diagnosis, puerperal phlegmon left broad ligament pointing through inguinal canal. Operation, incision through left groin. Recovered. Subsequent history, 4 years later she was well and had given birth to twins.

Mrs. B., November 11, 1895. Family physician, Wm. A. Cross. Diagnosis, puerperal pyosalpinx and intraperitoneal abscess, seen 18 days after labor; patient very ill and septic. Operation, direct incision and drainage. Recovered, with sinus. Subsequent history, abdominal section and removal of right pyosalpinx March 2, 1896; patient miscarried June 5, 1897; has been well since.

Mrs. L., December 12, 1895. Family physician, R. R. Stoner. Diagnosis, puerperal pyosalpinx 21 days after labor; edema of lungs; acute nephritis. Operation, direct incision and drainage; general peritoneal cavity opened and

packed with gauze. Recovered. Subsequent history, March 1, 1897, abdominal section; small right ovarian tumor and occluded right fallopian tube, and an adherent vermiform appendix removed; good permanent recovery.

Miss R., March 4, 1895. Family physician, W. E. Hall. Diagnosis, tuberculous pelvic abscess opening into rectum. Operation, incision through left groin for drainage. Recovered, with fistula. Subsequent history, subsequent abdominal section; left oophorosalphingectomy; October 30, 1897, and closure of fistula.

Appended is a table of the cases of incision and drainage.

SUMMARY OF TABLE OF ABDOMINAL SECTIONS FOR SUPPURATION IN UTERINE APPENDAGES TO MAY 18, 1901.

A. Division I.

Hysterectomy for circumscribed pus limited to uterine appendages:

Cases	46
Deaths	1
Mortality	2.1%

Division II.

Hysterectomy for intraperitoneal pus in addition to pus in uterine appendages:

Cases	4
Deaths	2
Mortality	50%

B. Division I.

Appendages removed for circumscribed pus contained in a tube or ovary:

Cases	74
Deaths	7
Mortality	9.4%

Appendages removed for circumscribed pus contained in a tube or ovary since January 1, 1895:

Cases	17 unilateral; 17 bilateral
Deaths	2
Mortality	5.8%

Division II.

Appendages removed for intraperitoneal abscess in addition to pus in ovary and tube:

Cases	22
Deaths	5
Mortality	22.7%
Total cases of abdominal section	146
Total deaths	15
Total mortality	10.2%

Mortality from abdominal section for pus cases previous to 1895: Cases 55, 9 deaths, 16.3% mortality.

Mortality from abdominal section in pus cases subsequent to 1895: Cases 91, 6 deaths, 6.5% mortality.

Cases of incision and drainage for pelvic suppuration	54
Deaths	1
Mortality	1.8%
Grand total of cases since January 1, 1895	145
Deaths	7
Mortality	4.8%

DISCUSSION.

DR. JOHN G. CLARK said that Dr. Noble's paper entirely coincided with his own views. He recalled a paper quite recently published by Schauta, of Vienna, who had reviewed a large series of pelvic inflammatory cases from the standpoint of the vaginal hysterectomist. Schauta concludes that vaginal hysterectomy is the operation of election for purulent collections in the appendages and believes that double salpingo-oophorectomy by the abdominal route, is unsatisfactory because of the disadvantages peculiar to abdominal incisions, and this operation has, therefore, been abandoned in favor of vaginal hysterectomy. He claims that vaginal incision is only an operation of necessity and cannot be considered a rival of the more radical vaginal hysterectomy. In Schauta's series of cases over 200 vaginal hysterectomies had been performed. Dr. Clark felt assured that in the hands of the conservative abdominal surgeon of America a considerable portion of these cases would have been saved from this radical procedure. Notwithstanding the fact that Schauta has condemned vaginal incision, uniformly good results have been observed in these cases at Dr. Clark's hands, and at least three of the patients have subsequently borne children. In referring to Schauta's paper, Dr. Clark intended to emphasize his approval of the course pursued by Dr. Noble in his large series of cases and to deprecate the employment of vaginal hysterectomy, for in the latter operation conservatism is almost out of the question.

DR. GEORGE ERETY SHOEMAKER said that he was in entire accord with almost all the positions taken by Dr. Noble particularly with the assertion that gonorrheal cases are not suitable for vaginal drainage. He said that large collections of pus without well-defined inflammatory infiltration were the best cases for vaginal drainage. The hard and compact mass, in which there may be but a small amount of pus is entirely unsuitable for vaginal treatment. Two cases of particular interest were cited. All operators, Dr. Shoemaker stated, are lessening their cases of abdominal drainage. He does not, however, advocate doing away with gauze drainage in desperate cases and in cases in which the bowel and bladder are injured. The skill of the operator in disposing of the pus at the time of operation has a large bearing upon the final result. In considering statistics it makes a tremendous difference whether the cases tabulated are pus cases only, or whether a general mortality in operation is considered, including all simple and clean cases.

DR. R. C. NORRIS thought that Dr. Noble had gone a little too far in his

advocacy of the vaginal operation, although he agreed with him that in many cases drainage by the vagina was applicable. Some 4 years ago Dr. Norris had closely observed vaginal operations in Berlin and Vienna. He had studied the cases at the operation and during convalescence, and had come away enthusiastic over vaginal section for pus cases, with the determination to try the method. The further experience of himself and of those of his friends whose cases he had since watched, however, had made him less favorably disposed toward it. He approved of the vaginal route in desperate cases in which there is a single, large collection of pus; in puerperal cases in which there is a circumscribed collection of pus; and in cases which are in extremis. For pyosalpinx, as commonly met with, he prefers the abdominal route, although he often drains through the vagina.

DR. MORDECAI PRICE said that in his opinion the teaching of the vaginal route for operations for intra-abdominal abscess is a step in the backward direction

DR. W. L. RODMAN said that he believed that there are many instances in which the low operation is advisable. It is, to a certain extent, surgery in the dark.

DR. CHARLES P. NOBLE said that he could not but feel gratified that the experience of the majority of the speakers had brought them to look upon the matter largely as his own experience had led him. The methods indicated by Dr. Price he had followed for a number of years. Now, however, instead of having a mortality of 16% it was less than 5; and, in the place of 27% mortality in complicated cases, his present method gave a mortality of less than 2%. In the substitution of hysterectomy for the bilateral removal of the appendages the mortality had been reduced from something like 8 or 9% to 2%. In his hands, at least, the abandonment of the old methods of Mr. Tait had resulted in a very great improvement, not only in mortality, but in that which was more important, the comfort and subsequent good health of the patients. In reference to the point raised by Dr. Norris that drainage was especially indicated in the complicated cases as a life-saving measure, Dr. Noble thought that a decrease in mortality from 27 to 2% showed that in that group particularly vaginal drainage was indicated. He had only done 54 drainage operations and 156 abdominal. Replying to Dr. Norris' query whether all pus pockets could be drained Dr. Noble admitted that if it were possible to have one large abscess, vaginal drainage for that condition would be ideal; but, unfortunately, in this work, ideal cases do not occur, and the conditions as presenting have to be met. In his 54 cases, in only about 6 was it necessary to do a second operation. By etherizing the patient a second time it is possible to drain the remaining pus pocket and recovery usually follows. In reference to a subsequent discharging sinus; of the 54, only one has such a sinus. This could be relieved but the patient refuses operation. In one other case in which there was tuberculous disease, the patient died of phthisis. In this case there had already been an opening in the rectum before the operation. In reply to the point raised by Dr. Norris that a conservative operation can be done from above, Dr. Noble did not think the complicated cases offered a proper field for conservative operations. It should be remem-

bered that in such cases there is a general smearing over with pus and infiltration with lymph and round cells. Therefore, when operating from above Dr. Noble had been driven to a radical operation to save the patient's life. Of the 54 cases only 12 had required the second operation. It was a mistake to suppose that if drainage is first done, the secondary operation is necessary as a rule. With the improved technique spoken of by Dr. Norris, Dr. Noble had recently had an opportunity to see what could be done in one of these cases. He found that the condition is exactly similar to those seen in former times.

SYMPOSIUM ON DIABETES.

[April 9.]

The Diagnosis of Diabetes Mellitus and the Urinary Findings in this Disease.

BY D. L. EDSALL, M. D.

Under ordinary circumstances, the diagnosis of diabetes mellitus is perfectly easy in cases that are at all severe. The symptoms are commonly such that the presence of this disease is at once suggested to any practitioner who is in the least open-minded, and the diagnosis is usually readily established by very simple methods of examination of the urine. It is not worth while to discuss cases of this kind, for the story told by the patient is generally such as to lead even a medical student who has never previously seen a case, to examine the urine at once, and it is particularly in cases which have the classical symptoms that the examination of the urine presents no difficulties and quickly settles the question.

It is, however, well known that many cases of mild diabetes, especially when they occur in elderly, over-fat persons, present none of the typical symptoms of the disease; and it is equally well-established, although not so generally recognized, that the severe, "pure" type of the disease may be causing grave disturbance of nutrition, without producing any of those symptoms which immediately suggest the necessity for an examination of the urine, while, on the other hand, the patient is often either somewhat dense and unobservant of his symptoms, or has grown accustomed to these symptoms and says nothing about them. Excessive appetite and thirst, and polyuria, are symptoms which suggest the existence of diabetes to anyone, and are by many physicians looked upon as being practically constant accompaniments of the disease when it is of the severe type. That this is not necessarily true, is, however, frequently demonstrated by clinical experience.

Of these symptoms, excessive appetite is most frequently absent. It is often not observed when the patient is especially depressed by any intercurrent illness or by the diabetes itself; it is not uncommonly absent when the disease is not severe and it is, of course, not present when the patient, either by chance or purposefully, provides himself with the proper amount of foods of the correct kind. The absence of marked polyuria is common, and at times so complete, as to have given rise to a special name, *diabetes decipiens*, for those cases in which a marked glycosuria occurs without polyuria; and if polyuria is absent, excessive thirst will, as a rule, naturally be absent also, as the excessive desire for fluids is chiefly dependent upon the loss of water in the urine.

It is, therefore, not at all uncommon to meet cases in which one or all of these symptoms are absent, and in which, nevertheless, the disease is severe; and it is not less common to elicit no history of these symptoms when some or all of them are present. I have, for instance, under observation, at present, a man who when first seen complained merely of marked weakness and loss of weight. He was, at that time, passing from 150 to 200 ounces of urine in the twenty-four hours, and this contained about 5 per cent. of sugar; the polyuria was such as to cause him to lose much sleep every night, through the disturbance resulting from the necessity for frequent micturition; he was, of course, drinking very excessive quantities of water; and he had an unusually large appetite, as certified to by the nurse. Nevertheless, until especially questioned about these matters, he said nothing about excessive appetite or thirst, or about the polyuria. He was intelligent, and recognized that these symptoms were present; but he had grown accustomed to them, and thought them of little consequence.

In cases, then, in which the classical symptoms of the disease are not elicited, the matter of chief moment is to recognize the importance of other symptoms or physical signs which are, in themselves, clearly suggestive of diabetes, and which demand an immediate examination of the urine. It is through overlooking these symptoms that most of our errors in diagnosis occur. In the severe type of diabetes there are two symptoms which are nearly always present, and, when present, are usually complained of in a way that is extremely suggestive. These are the emaciation and the pronounced feeling of muscular weakness. The occurrence of emaciation in diabetes is not to be wondered at; patients suffering from this disease are often losing, through the glycosuria, half the amount of food that a normal person requires for his daily work; and, if this is not replaced by an excessive amount of food of other kind, emaciation is inevitable. That

muscular weakness should occur under such circumstances, is also readily understood; but this weakness of the muscles in diabetes is not wholly explainable on the ground that the patient is being insufficiently nourished. It amounts, at times, practically to paresis; and more commonly than this, the patient exhibits a muscular weakness which is more marked than that seen in other diseases in which there is equally imperfect nutrition and equally excessive wasting of tissue. It is a weakness which is strongly suggestive of that which occurs in toxic states or, even more markedly, that seen in many diseases of the nervous system, and is probably due to a considerable degree to actual neuritis, or to the less severe effects produced upon the terminal nerves by the excess of sugar in the fluids of the body, possibly by other more directly toxic substances. This symptom is extremely striking and is often a very impressive part of the patient's story. Several other symptoms are usually recited as very suggestive. Among the most generally known is the itching, particularly of the genitalia; in men, balanitis is also very frequent. Closely associated with the itching are furunculosis and the development of carbuncles. Certain eye symptoms are also extremely suggestive, particularly cataract and loss of accommodation, the latter often being a very early symptom, and one that at times has been the first sign of the disease observed. There are, further, some nervous symptoms which should always suggest the possibility of diabetes. Among them is persistent neuralgia, especially neuralgia of the sciatic nerve; particularly when this is bilateral. Signs of neuritis, without other evident explanation, absence of the knee jerks and signs suggesting locomotor ataxia, are all occasionally present in diabetes, and each of them has furnished the first suggestion of the presence of the disease. It is also important to examine the urine in all such cases with another idea in view; namely, that diabetes occasionally arises in cases of organic nervous disease. Another symptom referable to the nervous system, and one that has also been repeatedly the first suggestion of diabetes, is impotence. A condition of another sort which is frequently complained of and may be readily discovered, but which is not commonly recognized as being suggestive of diabetes, is marked gingivitis, which is often associated with pyorrhea alveolaris and necrosis of the teeth. This is present with very great frequency in diabetes; it is often complained of, and discovery of its presence should always suggest an examination of the urine.

Furthermore, an examination of the urine for sugar should always be undertaken in persons who are at all obese; in those who are of gouty families or who have gouty tendencies; and in those who have a family history of diabetes or are neurotic or who come of neurotic

families, particularly if they exhibit any symptoms the cause of which is not clear; and it may, of course, be properly said that an examination of the urine for sugar is an essential part of a careful investigation of any case especially if it is not readily understood.

When one's thoughts have been directed toward the possible presence of diabetes, all doubt is usually quickly cleared up by an examination of the urine. If, with the ordinary copper tests, a reddish-yellow or red precipitate, in considerable amount, is obtained before the specimen is actually boiled or when it has been boiled for decidedly less than a minute, there is, practically speaking, no question that abnormal quantities of sugar are present. The same is true of the bismuth test, which is almost as satisfactory as the copper test for rough clinical purposes. If in testing, the specimen has been boiled as much as half a minute before reduction occurs, the result is questionable.

If these tests are negative,—particularly, in cases which are under suspicion, if they are repeatedly negative when the patient is taking large amounts of carbohydrate foods—this is sufficient to exclude the presence of diabetes.

The chief difficulties that are met with occur in determining the nature of cases in which a doubtful reaction occurs; or in which a distinct reaction for sugar is obtained either only once or over but a short period, and not subsequently. The latter cases will be discussed later. As to the former, it is well known to everyone that in testing for sugar with copper solutions one frequently finds that the solution becomes of a somewhat dirty, greenish color, or it is largely decolorized, it grows yellowish or somewhat reddish in color, without the deposit of an actual precipitate, or a precipitate usually yellow in color does form, generally more slowly than when a frank reaction occurs and often only after decided boiling or after adding considerable amounts of urine. Rather less commonly, one will find that after prolonged boiling the reaction apparently becomes suddenly, distinctly positive, while testing without prolonged boiling gives only an indefinite reaction or none at all. It is generally known that uric acid and creatinin, both of which are normally present in the urine in considerable amounts, will, when present in decided excess, produce a reaction with copper. It is not so commonly known, however, that one of the most frequent causes of an apparently positive reaction for sugar is the presence of so-called glycuronic acid compounds, the recognition of which by fairly simple procedures is comparatively easy—decidedly easier than the satisfactory determination that either of the other substances mentioned is present in excess.

When such reactions are obtained, there are several methods of

determining whether sugar is present or not. In the first place, a distinct reaction for sugar may at times be obtained by diluting the urine, when the result with concentrated urine has been doubtful. Again, with the questionable reactions that are due to uric acid and creatinin in particular, the method suggested by Sir William Roberts, which I have repeatedly adopted with satisfaction, will often clear up the question. One allows two or three ounces of urine to run repeatedly through animal charcoal which has been loosely packed in a funnel. As a rule, if the reaction was not due to sugar, all semblance of reaction will have disappeared from the urine; while, if it was due to sugar, the result will be more definitely positive than it was before. Under ordinary circumstances, this test is satisfactory; but if slight amounts of sugar are present, losses will occur in passing it through animal charcoal; hence only a positive final result is reliable. Further, glycuronic acid compounds are not gotten rid of by this method; and, in case the reaction still remains doubtful, their presence must be looked for, and sugar excluded by other means.

The simplest, most definite and most satisfactory methods of clearing up these questions are the use of the fermentation test and of the polarimeter, if the latter is at hand. If the fermentation test is positive, in connection with a positive copper test, there can be practically no question that the substance present is grape sugar or dextrose. This test is the simplest and surest at the service of the practitioner. It is absolutely essential, in carrying out a fermentation test, to acidulate and to use a control test at the same time, if only small quantities of sugar are present. Commercial yeast often contains small amounts of fermentable sugar and also after a few hours the growth of the yeast spores may cause fermentation of the bodies of the old yeast cells and thus small amounts of gas may be formed. Much quicker than the fermentation test, and usually quite as distinctive, is the use of the polariscope, if this instrument is available. The disturbing substances that may give rise to a suggestion of glucose reaction are usually levorotary, if they influence rotation at all. If dextrorotary, they are but weakly so, and are readily distinguishable from glucose in this way.

If, then, the copper test, and either fermentation or polariscopy, or both, give positive results, there can be no question that sugar is present. If the copper test is positive or doubtful, and the fermentation test is doubtful; if there is very slight dextrorotation, or none, or the polariscope is not available, the best method is to use the phenylhydrazin test. Usually the most satisfactory method of carrying this out is the old way—heating about one-third of a test-tubeful of urine, with phenylhydrazin hydrochlorate and sodium acetate for about half

an hour in a vessel containing boiling water. Twice the amount of phenylhydrazin hydrochlorate sufficient to cover the point of a knife-blade, and of sodium acetate three similar portions, should have been added and dissolved before placing the tube in the boiling water. After the heating, the tube is placed in cold water. A precipitate soon appears, and this may be seen microscopically to consist of needle-like crystals, which are in large part arranged in bundles resembling wheat-sheaves. A still more distinctive method of carrying out this test is that of Fischer. Lead acetate is added to the urine, the mixture is filtered, ten drops of phenylhydrazin and acetic acid are added to twenty cc. of the filtrate, and the test is then carried out as before with heating and cooling. This test is feared by many because of the time it takes and the apparatus necessary; in reality, however, the older method first mentioned takes very little actual working time—not more than five or ten minutes, usually—and the only apparatus necessary is a test-tube and a tin can or small tin pail in which water may be boiled over an alcohol lamp or gas burner, or on a stove. The modifications of this test recently suggested by Neumann, Kowarski and others are much more rapidly carried out, but cannot be considered reliable. If positive results are obtained the question is settled, but Cipollina has shown, as was to be anticipated, that with these tests and probably with his own modification (which he considers more reliable), crystals may not form for as long as an hour if only small amounts of sugar are present. Hence these modifications are of no great value in those cases that are actually troublesome, *i. e.*, in those in which only small amounts of sugar are present.

If, however, the phenylhydrazin test is positive to the extent that typical wheat-sheaf bundles of crystals are found, it is practically distinct proof of the presence of sugar. Stray crystals are not distinctive, nor is the mere presence of numerous crystals of non-characteristic form. This test is the most certain that we have. I confess, nevertheless, that I do not share the absolute faith in it which is commonly expressed; for it has been shown by Neuberg and others that after prolonged heating glycuronic acid forms suspicious looking, needle-like crystals with this procedure. These crystals may be recognized by determining their melting point, but this is entirely out of the question under ordinary circumstances. This objection is, however, of but slight importance as the prolonged heating necessary to the formation of these crystals is usually sufficient of itself to exclude error from this source.

When, however, we have shown beyond reasonable doubt that sugar is present, we do not, as a usual thing, need to proceed further. If, on the other hand, we have a reaction to copper which closely

resembles a dextrose reaction, and yet fermentation is negative, doubt is likely to cling to one's mind unless the nature of the substance causing the reaction is determined. A reaction to copper without fermentation is most frequently due to glycuronic acid compounds. It is usually these compounds that give a reaction after chloroform anesthesia and after the use of chloral, camphor, thymol and copaiba, and occasionally after that of morphine and other drugs; at times these compounds are also present during the course of infectious diseases, in neuroses, in gastro-intestinal disturbance and in diabetics when actual sugar has disappeared from the urine, in such excess as to give rise to a very suspicious reaction. As a rule, the copper reaction under such circumstances appears distinctly only when the test has been subjected to decided and prolonged boiling, this circumstance itself suggesting that the reducing substance may not be sugar. More distinctive than this, is the fact that these compounds do not undergo fermentation. Their actual presence may be determined by the fact that they rotate polarized light to the left, as they are found in the urine; but that, after heating the urine with sulphuric acid (1 or 2 per cent.), glycuronic acid itself is set free, and this free glycuronic acid rotates to the right. Also, after heating with 1 per cent. sulphuric acid and then with an orcin-HCl solution, a fairly characteristic color-change occurs, and a distinctive spectroscopic band may be found.

Rarely, pentoses (sugars containing five atoms of carbon) may be present in the urine, and may give rise to decided confusion, since they freely reduce copper and also show dextrorotation; they do not ferment, however; they rotate relatively little, as compared with their powers of reducing Fehling's solution; and they give a red color and a characteristic spectroscopic band when warmed with hydrochloric acid and phloroglucin. They also give the orcin-HCl reaction without previous heating with acids. In the rare cases in which they occur without dextrose, it is important to recognize the nature of pentoses; for, in the absence of glucose, the case is of wholly different nature from one of ordinary glycosuria. The exact importance and significance of chronic pentosuria is not well determined, but the condition is certainly not actual diabetes.

Still more rarely, alkaptonuria may be the cause of error, since the homogentisic acid which is passed in this disorder reduces copper. This is comparatively easily distinguished, however, by the absence of fermentation; by the presence, or the ready development after standing, of deep pigmentation of the urine; by the fact that bismuth tests are almost or entirely negative; and by the occurrence of a blue color on adding a small amount of ferric-chloride solution.

The tests recommended by Bremer and Williamson for the diagnosis of diabetes by the examination of the blood, I have used, although only rarely and without enthusiasm. It is almost certain that both of them depend upon the existence of hyperglycemia and that they are, therefore, likely to occur only when the latter exists. Glycosuria, however, is practically always present when hyperglycemia is. As a consequence of these two facts, it is highly probable that neither of these tests would be certainly positive if glycosuria were absent. Bremer claims that the contrary is true of his test, but his observations have not been supported by those of others. Of the two tests, Williamson's seems the more rational. It has been the experience of others, and it is wholly reasonable to expect, that Bremer's test would occur in other conditions than diabetes. Williamson's is certainly seen but rarely in any other disease, probably because the decolorizing of methylene blue in alkaline solutions practically never occurs at body temperature and in the body fluids except when excessive amounts of sugar are present. That the test is due to the excess of sugar has been made very probable by various experiments concerning the influence of methylene blue upon sugar, and by the curious observation of Assfalg that a patient who exhibited alimentary glycosuria and who was given methylene blue at the same time, excreted the chromogen in the manner that is customary to normal persons, while the dye itself was not excreted at all until a period when the urine was free from sugar. A similar observation was mentioned by Riesman in a discussion at a meeting of the Philadelphia Pathological Society a year ago. A patient, with severe diabetes, who was given methylene blue, excreted none of the dye as such; while a milder case of the disease did excrete the dye.

These tests seem to me to be of interest but not of importance in actual diagnosis. Williamson's test might be of real value in doubtful cases of coma if urine could not be secured; but the other symptoms will probably always be of greater value.

As was said before in speaking of urinary tests, a frank reaction to copper when the test has not been actually boiled hard, practically always means sugar; and if such a frank reaction occurs, or if a questionable reaction has been shown to be due to glucose, this by far most commonly means that diabetes is present. It is always, however, strongly advisable to postpone making an absolute diagnosis of diabetes until at least one test carried out at another time has also proved positive, and until the circumstances attending the case have been carefully inquired into. It may be worth while to repeat the old warning that, in private practice par-

ticularly, one must first be sure that the sugar was passed with the urine. It is, of course, well known, though not sufficiently well remembered, that persons who have hysteria or who are indulging in simulation occasionally introduce sugar into their urine, but private patients, in particular, at times unconsciously give rise to much bother and anxiety by bringing urine in bottles which have contained sugary solutions and have not been rinsed. I have repeatedly known this to be the cause of much worry. Aside from such occurrences, however, it is known to almost every one that glycosuria may appear temporarily, as the result of marked alcoholic excess or of either physical or emotional shock, sometimes after great excess in eating actual sugar, in rare instances as a consequence of poisoning of various kinds, and sometimes in the course of or during convalescence from acute infectious diseases. Under these circumstances, the glycosuria may follow any one of three courses: It may be extremely transient, or persist but a short time and then disappear permanently; it may soon decrease or disappear, and afterward reappear; or it may remain persistently after its first appearance. In either of the latter two cases, we have a diabetes; but in the former, actual diabetes may never develop. Cases which give rise to the same diagnostic difficulty as those last mentioned, but which are always decidedly more suspicious, are the instances in which, without any definite cause that can be determined, sugar is found once or perhaps on several occasions, and then disappears over a somewhat prolonged period of observation. It is always difficult to determine definitely whether diabetes is present in either of the above varieties of cases; or, more particularly, whether diabetes is about to develop. If there has been some such condition as severe shock, poisoning or acute disease, and if the glycosuria is but transient and does not reappear for some weeks afterward on repeated testing, it generally will not do so at all; if, however, the glycosuria has appeared without any clear cause, but has definitely been shown to be present, it is almost always unsafe to state that diabetes will not subsequently appear. Probably the most satisfactory method of dealing with either of these varieties of cases is to place the patients on a diet which includes unusually large quantities of starches (not sugars), and to determine, after this diet has been persisted in for at least a week or two, whether it has caused a return of the glycosuria. If it has not, it is practically safe to say that the patient's powers of assimilating carbohydrates are normal; if it has returned, he should be classed as a very mild diabetic.

There can be but little question that cases of this kind—namely, of very brief, transitory glycosuria—are not so common as reports would indicate. I have no doubt that a large proportion of the reac-

tions obtained under such circumstances and attributed to sugar are due to the presence of other reducing substances, probably chiefly glycuronic acid; and this statement is particularly likely to be to point when the patient is under medication. A very considerable number of cases of this kind are shown by the reports to have been taking some such substance as chloral or camphor, the excretory products of which will cause decided reduction. The actual necessity for deciding as to the nature of such cases is, therefore, comparatively uncommon when tests are properly made. A much more common occurrence is, in elderly, fat persons particularly, to see glycosuria appear, disappear and reappear repeatedly. Such cases, while of wholly different prognosis from essential progressive diabetes, and while very likely of distinctly different nature, must, in the present obscurity concerning the pathogenesis and nature of the disease, be classed as actual diabetes.

A further condition which deserves mention because it is not sufficiently generally recognized, though well known to obstetricians and students of nutritional disorders, is the lactosuria of pregnancy and lactation; for, unless this condition is recognized, it is likely to be wrongly considered to be diabetes. The appearance of lactose in the urine of a pregnant or nursing woman has no known pathological significance, except incomplete emptying of the breasts or excessive secretion of milk, and it is very common. It is wholly distinct from diabetes. Even the appearance of glucose may not mean diabetes, for glucose not infrequently appears at this period only to disappear after a short time without being accompanied by any constitutional disturbance. Glycosuria is, however, a far graver matter than lactosuria and actual diabetes not infrequently first appears during or soon after pregnancy.

There are still a few points to be spoken of in connection with the examination of the urine—chiefly those changes in the latter which are seen when coma is approaching or when it is actually present. These alterations are, from the clinician's standpoint, the appearance of acetone in large amounts and of diacetic acid. Acetone is normally present in the urine, but in amounts too small to respond to ordinary tests. In any severe case of diabetes, acetone will usually be found by ordinary tests. If the patient is on a strict or moderately strict diabetic diet, the reaction for acetone is frequently marked, even when there is no suggestion of coma and no immediate danger of it; indeed, a pronounced reaction for acetone may be found in the urine under a variety of circumstances, the chief factors associated with its occurrence being the ingestion of undue amounts of fatty or proteid food—especially of fats—with reduction of the carbo-

hydrate food, a loss of body tissue, gastro-intestinal disturbance, and various intoxications and infections. The mere presence of acetone is, therefore, not at all distinctive, either of diabetic coma or of anything relating to diabetes alone. In a case of actual diabetes, however, if acetone is present in large amounts and especially if the quantity tends to increase, this is sufficient to be a warning that there is danger of the onset of coma, and is often a warning that it is advisable to alter the diet and, particularly, to administer large doses of alkali.

The same statements may be made concerning diacetic acid that have been made with reference to acetone, in regard to its presence in other conditions, although they must be more restricted. Diacetic acid occasionally appears in other diseases, its appearance being chiefly dependent upon the intensity of the intoxication. Under ordinary circumstances, the reaction for diacetic acid means that one will obtain a strong reaction for acetone, and it is looked upon as indicating that the intoxication is a severe one. More recent researches seem to indicate with considerable probability that all the acetone found in the urine is really passed as diacetic acid; if it is present in small amounts, the diacetic acid is almost at once completely oxidized to acetone, while if passed in large quantities, the diacetic acid persists for a longer time in greater or lesser amounts. If this is the case, any conclusions to be drawn from the test for diacetic acid must be based upon an examination of very fresh urine, as otherwise the intensity of the reaction and even the occurrence of a positive reaction may vary greatly in accordance with the time that has elapsed since the urine was passed. Hence, even the occurrence of a diacetic acid reaction may perhaps not mean a very intense intoxication, if the urine is examined quite fresh; and we need to study this question more definitely from this standpoint before we can say absolutely that the mere presence of diacetic acid does mean grave intoxication. This view seems to be sustained by recent work, particularly that of Hesse, carried out with Liplawski's method. This is much more delicate than the ferric chloride test and, according to Hesse, reacts positively in almost all instances if marked reactions for acetone are obtained. As the test is usually carried out, however, with ferric chloride and with urine that is not fresh, if there is any notable amount of diacetic acid present, it certainly means that the intoxication is severe.

It is to be remembered, however, that other substances may give a reaction with ferric chloride wholly similar to that produced by diacetic acid and it is always best to carry out a control test with urine that has previously been boiled. In this specimen the diacetic acid will have been oxidized or driven off; and if a reaction, as intense as before, is still obtained, it indicates that other substances cause it.

A more direct result may be obtained by testing the ethereal extract of urine that has been acidified with sulphuric acid. A ferric chloride reaction for diacetic acid in the ethereal extract directly indicates the presence of this acid.

These tests are the only ones which are ordinarily at the service of the clinician outside of hospitals or special laboratories. If more extensive apparatus is at hand, other more accurate and more distinctive tests of the approach of coma may be carried out. These are estimations of the beta-oxybutyric acid and the ammonia of the urine. Large amounts of beta-oxybutyric acid always indicate severe acid intoxication, and, hence, denote danger of coma. This substance rotates polarized light to the left; its amount, therefore, may be roughly determined by finding the quantity of sugar indicated by titrating with Fehling's solution and the quantity determined by polarimetry. The latter result will be smaller than the former, and the difference between the two will roughly indicate the quantity of beta-oxybutyric acid. Still better, the test can be carried out by reading the polariscope before and after fermentation of the urine, and thus determining the quantity; or, best of all, by making a complete ethereal extract of the fermented urine and examining this with the polariscope.

The estimation of ammonia is exceedingly simple, if one has at hand some standardized alkali and acid solutions. It consists then merely in placing a definite quantity of the standardized sulphuric acid under a bell-jar, over a definite quantity of urine to which milk of lime has been added in excess, the bell-jar being placed over the solution immediately after adding the lime. The ammonia is set free and absorbed by the acid. After three or four days, the acid is titrated with alkali, and the amount of ammonia is calculated from the amount of acid neutralized. The ammonia should not reach two grams per day. A decided increase over the normal quantity of ammonia indicates acid intoxication, and the intoxication varies directly with the amount of ammonia. The reason that this is true is the apparently well-established fact that under the ordinary circumstances urea is largely formed by synthesis from ammonia. Normally a little ammonia (about 0.5 to 1 gm.) is passed as ammonia salts; this quantity is used, therefore, to neutralize the acids normally present in the system. If the acids in the system increase in quantity, more ammonia is, as far as is necessary, used by the system to neutralize the excess of acids, instead of going to produce urea; and this neutralization of acids with ammonia goes on in proportion to the amount of acid intoxication, as far as the system is capable of carrying on this process. Ultimately, the acid intoxication grows so great that this method of antidoting it is insufficient, the fixed alkalies are used for this purpose, the

organism becomes supersaturated with acids and the actual clinical evidences of intoxication appear and are likely to advance to coma. The estimation of the ammonia is, therefore, the readiest and most exact method, for clinical purposes, of determining the degree of acid intoxication. There is still another method, *i. e.*, balancing the acids and alkalies of the urine and determining the excess of the total alkalies, but this is too complicated for any purposes except those of research.

As to the changes in the urine other than those that are very directly a part of the diabetic disturbance: The urea is usually increased. If the patient is being properly dieted and is doing well, this has no further interest than to be an indication of the fact that he is taking an abnormally large amount of nitrogenous food. On the other hand, it may be due to toxic tissue destruction, when there is severe intoxication, or may be due to a tissue destruction caused by lack of sufficient food of proper kind. The phosphates are likewise usually increased because of the excessive proteid diet, and a marked deposit of phosphates has given to one class of cases the name phosphatic diabetes. The sulphates, chlorides and other inorganic salts are, like the phosphates, increased because of the diet; and they have, under ordinary circumstances, little interest. A rare occurrence is the passage of gas in the urine—so-called pneumaturia, apparently due to the fermentation of sugar in the bladder. Finally, a matter of some decided interest is the appearance of albumin and casts. The former is found in a large proportion of cases of diabetes in small amounts; accompanied, at most, by only a few casts; and unaccompanied even after years, by dropsy or other evidence of nephritis. In these cases, the albumin means nothing more than constant irritation of the kidneys, due to the persistent passage of large amounts of sugar, and to some extent, also, to the demands upon those organs in excreting excessive amounts of other substances—urea, inorganic salts, etc.,—which are almost always in excess because of the diet. Occasionally actual nephritis, with considerable quantities of albumin, with notable quantities of casts, and with the other signs of nephritis, may occur, either in association with diabetes or as a complication of the disease. Under such circumstances, it is not very uncommon to see the glycosuria diminish to some extent; and occasionally the diabetes has actually disappeared, and has been entirely replaced by a chronic nephritis. Diabetes occasionally terminates with actual uremia, although this is uncommon. It is of some interest because the terminal condition is then likely to be mistaken for diabetic coma. One matter of a certain degree of importance is that casts have repeatedly been found in very large numbers during coma, and even for several days before its

onset; and certain authors believe that the examination for casts may be an important method of foreseeing the onset of coma. In a limited sense, this is almost certainly true; that is, if casts are found suddenly and in large quantities, it strongly suggests the occurrence of coma; but they are not usually present, and the value of this method of observation is, therefore, a limited one.

Diabetes in Children.

By J. P. CROZER GRIFFITH, M.D.

Although diabetes occurs at any age, its presence in children and infants is certainly comparatively rare. Pavy (quoted in *Deutsch. med. Woch.*, 1886, 477), out of 1,360 cases found only eight in children under ten years; and Mayer (*Arch. f. klin. Med.*, 1888, 514), in 380 cases only one of ten years or less. According to the statistics given by Naunyn (*Nothnagel's Path. und Ther.*, VII, 1, 124), out of 6,496 cases dying of diabetes in England and Wales from 1861 to 1890 only eight were under one year of age, seventy-four under five years, 114 from five to ten years, and 200 from ten to fifteen years. Külz (*Gerhard's Handb. B. 3, H. 1, 275*), writing in 1876, collected, after a careful search of literature, 111 cases occurring in children of fourteen years or less. Redon (*Gaz. Méd. de Paris*, 1877, No. 17, 213), reports thirty-two cases seen by himself. Stern (*Arch. f. Kinderh.*, 1889-90; XI, 81), collected 117 cases from the literature, some of which are included in Külz's list. Wegeli (*Arch. f. Kinderh.*, 1895, XV, 1), added 108 more cases collected from the literature.

The experience of no one observer of diabetes in children can be very large. I have myself seen a few cases of the disease;—just how many I am unable to say, as notes of all of them have not been preserved.

ETIOLOGY.—Age. According to the investigations of Frerichs and of Seegen the relative frequency at different ages is as follows:

		Percentage.		Percentage.	
Under 10 years	Frerichs	1	Seegen	0.5
From 10 to 20 years	"	7	"	3
" 20 to 30	"	"	10	"	16
" 30 to 40	"	"	18	"	16
" 40 to 50	"	"	25	"	24
" 50 to 60	"	"	26	"	30
" 60 to 70	"	"	11	"	10
Over 70	"	"	1	"	0.5

About the age of puberty the disease becomes less unusual. Yet as von Noorden has pointed out, we do not know just when the disease first commenced in most of these cases. In infancy the affection seems to be rarest. Of Külz's 111 cases, only seven occurred at the age of two years or less. The youngest was but fourteen days old, or, of the cases which he regarded as undoubted, seven months. Six of Stern's cases were less than one year when the symptoms appeared, and in one case, reported by Kitselle, the child appeared to have been born with the disease. Of Wegeli's cases four were one year old or less, thirty were five years old or less, forty-eight were from six to ten years of age and eighty-one from eleven to fifteen years.

The youngest case of which I have had cognizance, although I did not see the patient, was in an infant of three months. The youngest actually under my care was five years old. I have seen one of seven years and one of eleven years and have the notes of another of nine years.

The influence of inheritance or of family relationship in its bearing upon age is also interesting. In five of Külz's cases other children of the family were diabetic also. The disease is more common among the Hebrews at any age, and the occurrence of family diabetes in children seems especially prevalent in this race. In a few cases the direct inheritance from diabetic parents has been reported. Not infrequently, too, the inheritance seems to be from grandparents, uncles or aunts who have suffered from the disease, or who have a neuropathic history.

Sex exerts a considerable influence. Statistics for diabetes in general show a very decided preponderance of males affected. In children, however, both sexes seem nearly equally attacked. According to Külz and Stern there seems to be a preponderance of females. Stern's cases exhibited a ratio of 5 : 3 in favor of females.

There seem at times discoverable certain *exciting causes* for the development of the disease. Injuries or diseases of the nervous system are prominent here. Falls upon the head, the presence of meningitis or other diseases of the brain have been noted repeatedly. Eleven of Wegeli's cases had suffered some form of trauma. So, too, diabetes has followed promptly the occurrence of other diseases, especially those of an infectious nature. Imperfect hygiene of some sort has been a probable cause in a number of reported cases, as have long continued diseases of the digestive apparatus.

SYMPTOMS.—The symptoms do not differ materially from those seen in later life, and therefore do not require any special discussion in this connection. They are extremely variable, and the date of the onset of the disease can seldom be determined. Very often the first

symptom noticed is merely a tendency of the child to waste, in spite of the fact that its appetite is good and that its food seems to agree. The sleep is disturbed, the breath heavy and the disposition may change. Digestion is often much disturbed and especially there may be a tendency to vomit. With these symptoms come often thirst and dryness of the skin. There is an increased secretion of urine and nocturnal incontinence is not at all infrequent. Infants with diabetes have been known to wet diapers twenty or twenty-four times in twenty-four hours. Sometimes incontinence of urine is the earliest symptom noticed.

The DURATION AND COURSE of the disease is very variable. Some of the cases exhibit a lighter and more chronic form; others are more rapid and severe. In general, the disease is apt to be of a more severe type and of a more rapid course in proportion to the youth of the patient; although to this there are many exceptions. The course is apt to be shorter in children than in adults, whether the disease terminates in death or in recovery. Cases lasting only a month or less have been reported. Death may come from exhaustion or intercurrent maladies, especially pneumonia. Not seldom the patient dies in coma.

The PROGNOSIS is usually very bad in childhood, and the younger the child, as a rule, the worse this seems to be. Külz's table shows fifty-seven deaths to have occurred out of the 111 cases reported, and recoveries are reported in only six cases, with the admission by the writer that it could not be told how many of them could be considered permanent. The termination is reported as known in seventy-seven of Stern's cases, of these fifty-two died. Of Wegeli's 108 cases, sixty-nine, *i. e.*, 64 per cent. died. In only six of his cases could recovery be considered as permanent.

Little need be said of the TREATMENT. It does not vary materially from that in adult life, except that in infancy it becomes increasingly difficult, owing to the fact that we cannot well do without the milk upon which the child depends. I have seen one case of five years apparently cured, at least as long as it remained under my observation, by the use of antipyrin, and without any material alteration of diet. This may be regarded as a light case, and a very exceptional one in its result. Sodium salicylate, arsenic and codeine are recommended, as in adults. Dietetic treatment has worked well in other instances. In still others nothing has been of any avail. One's experience in this disease in children and infants corresponds entirely with that in older patients.

Ocular Affections Associated with Glycosuria, with Especial Reference to Central Amblyopia.

BY WALTER L. PYLE, M. D.

Ocular affections associated with glycosuria have been recognized for many years and numerous records of cases are found in ophthalmic literature, even in pre-ophthalmoscopic days. Although in some of the cases reported, the ocular lesion was purely incidental to the general debility, yet there is ample evidence to establish a direct causal relation between disturbance of carbohydrate metabolism and ocular disease. Nearly every part of the visual apparatus may be affected.

According to Kleen, two-thirds of all diabetic patients suffer from some disturbance of vision, and occasionally the ocular symptoms are the first noticed, although generally they appear after the disease is well established. Bouchardot says that there is some visual disturbance in 20 per cent. of diabetic cases, commonly with no ophthalmoscopic signs. Hirschberg¹⁸ believes that the ocular changes are frequently overlooked, and that in very chronic cases, retinal lesions are always present. Lagrange²⁰ observed in the ophthalmic clinic of Bordeaux, among 20,000 cases, fifty-two with diabetic affection. In one hundred diabetic cases examined by O. W. Moore²⁹ there were twenty-one instances of ocular affection, distributed as follows:

Amblyopia without ophthalmoscopic evidences, four; cataract, four; glycosuric retinitis, five; hemorrhage and floating bodies in the vitreous, four; paralysis of accommodation, three; iritis, one.

The means by which diabetic disorders may affect the eye are as follows: (1) Abstraction of water from the ocular tissues, due to the increased density of the blood, as, for instance, in diabetic cataract. (2) The presence of sugar or its derivatives in the intra-ocular humors. (3) Lessened resistance of the ocular tissues, the result of general nutritional derangement. (4) The presence of a toxic substance in the blood, causing irritation, inflammation and degeneration. (5) Through the cachexia incident to the disease, the bloodvessel walls are so affected as to allow transudation of the corpuscular elements into the retinal tissues. Again, the smaller vessels, particularly the capillaries, are very susceptible to the influences of toxic substances in the blood, and undergo certain degenerative changes that favor hemorrhage. In the retina this causes localized degeneration on account of the absence of arterial anastomosis. Hemorrhage into the sheath of the optic nerve may be a cause of the optic atrophy observed in diabetes.

The prognostic significance of ocular complications in glycosuric

affections, while not definitely established, is certainly of much less importance than in albuminuria. Clinically, diabetes may be considered a metabolic disturbance of greatly varying degree and permanency. It may be functional or organic, and, according to its severity, there is corresponding variance in the resultant symptoms. Distinct types have a very dissimilar pathology. Glycosuria may occur in gouty and obese patients, and these cases may pass on to true diabetes mellitus. Excessive mental and nervous strain, emotional excitement and dietary indiscretions are common factors in its production. Some cases seem to be the result of trophic nervous disorders. Diseases of the pancreas may exist with or without glycosuria. Many of the infectious diseases and some disorders of the liver, such as acute yellow atrophy and portal thrombosis, may be associated with glycosuria. Lesion of the floor of the fourth ventricle is a well-known cause. There is a type known as renal diabetes. Phloridzin poisoning produces a glycosuria apparently dependent on diseases of the kidneys. Subcutaneous injections of solutions of adrenal extract may produce hyperglycemia and glycosuria; and these conditions may follow ether-inhalations, the ingestion of amyl nitrite, hydrocyanic acid, sulphuric acid, strychnine, nitrobenzol, phosphorous, glycerine, mercury and alcohol and the excessive use of tobacco.

Mild forms may never progress to the severe types, and, in fact, in arthritic, gouty or obese patients, with excessive appetites, Lauder Brunton⁵ and others believe that the glycosuria is a safety valve, so to speak, to discharge the excess of carbohydrates ingested. Certainly, such patients may have glycosuria of a large amount for a protracted period, with perhaps ocular complications, without danger to life, if even ordinary dietetic precautions are observed. Naunyn says that admittedly light forms of diabetes always remain benign, while fatal cases are easily recognized from the first.

In some of the marked cases of ocular involvement, both the ocular and general symptoms may improve or disappear, or the ocular condition may remain stationary and the patient recover general health. The most important point in prognosis is the condition of the retinal bloodvessels, as this is an index of the general vascular health.

Disturbances of Accommodation and Refraction.—The only ocular symptoms may be transient dimness of vision, failure of accommodation or sudden and marked changes of refraction. Von Graefe¹⁷ was among the first to note these minor disturbances, and he was followed later by Nagel, Förster,¹⁴ Seegen⁴² and many others. Premature presbyopia should always excite suspicion of general disease, particularly diabetes.

The Pupil.—There may be unilateral or bilateral mydriasis, with

deficient light-reaction. In 140 cases of diabetes, Seegen⁴² found pupillary anomalies in three, one of which was due to a tumor of the medulla.

The extra-ocular muscles may suffer from paresis or paralysis, particularly the external rectus, whose governing nerve, the abducens, has a very deep origin in the floor of the fourth ventricle. These muscular anomalies may improve, disappear or remain permanent, according to the progress of the general disease. They are more likely to be permanent when they develop late in the disease. The cause is likely a peripheral neuritis or hemorrhage or nuclear lesion.

Sudden and marked change of refraction is an occasional phenomenon of diabetes. In rarer cases there is a development of hyperopia, which subsequently varies with the glycosuric symptoms. According to Landolt,²¹ this is due to a change in the refractive index of the vitreous. Horner has suggested that the presence of sugar might result in the dehydration of the vitreous body, with consequent decrease in the size of the eyeball. Again, the sudden appearance of the hyperopia may be the result of paresis of accommodation in a subject under middle age, allowing a hitherto latent hyperopia to become manifest.

A more common change is the development of myopia or increase of a pre-existent myopia, even without cataractous changes. This may subsequently diminish or increase according to the glycosuric state. In 1897, Risley²⁵ reported two notable instances of this nature, in one of which death has since occurred. The onset of myopia in patients past middle age without marked lenticular changes should be a cause for suspecting diabetes. At the last meeting of the Dutch Ophthalmic Society, Leyden (1901), Van der Brugh called attention to the fact that increase of the refractive index of the nucleus of the lens increases the total refraction of the eyeball, while increased index of refraction of the cortex decreases the total refraction. Schapringer has mentioned that decrease of the refractive index of the vitreous increases the refraction of the eyeball. An equal percentage of sugar in aqueous and vitreous would tend to produce hyperopia rather than myopia. In diabetic myopia there must be an increase of the curvature of the surfaces of the lens or a larger quantity of sugar in the aqueous than in the lens or vitreous. It is stated, however, that the ocular humors seldom contain more than 0.5 per cent. of sugar; while according to Deutschmann, the fresh crystalline lens of a human cadaver will remain clear in a 2 to 3 per cent. solution of sugar. Koster has suggested that irritation of the ciliary nerves and spastic contraction of the ciliary muscle may explain the myopia in some cases. Du Jardin¹⁰ has

noted a striking instance of this kind in a woman of sixty-nine, with pronounced diabetes. The vision suddenly changed until a pair of + S. 4.00 lenses could be discarded for reading, while distance vision fell correspondingly. As the pupils resisted strong solutions of atropine, it is likely that in this case, notwithstanding the advanced age, spasm of the ciliary muscle was the causative factor, rather than a physicochemical change in the crystalline lens.

Cataract in diabetes has been commonly attributed to the abstraction of water from the lens, due to the altered composition of the intra-ocular fluids. If a fresh transparent lens is laid in a solution of salt or sugar, it becomes cloudy; but if put immediately in fresh water it becomes clear again. According to Fuchs, if the bloodvessels of a frog are injected with a solution of sugar or salt of sufficient density, the lenses will become opaque; but if the frog is placed immediately in fresh water the lenses will clear. However, recent analyses of the aqueous in diabetic patients have shown that the proportion of sugar contained in it, is too small to produce an opacity in the experiments cited. Therefore, it is likely that we must attribute the lenticular changes in diabetes to some more complicated disturbance of the nutrition of the lens than the simple abstraction of water. Fuchs adds, however, that the form of cataract that sometimes appears in the last stages of cholera, probably depends on the latter cause.

Cataract is the most generally known ocular symptom of diabetes. In the statistics of von Graefe,¹⁷ Lagrange²⁰ and Galezowski,¹⁶ it occurs in 25 per cent. of all chronic cases. More recent observations, which include the milder cases, with glycosuria the principal symptom, the percentage is reduced to nine in Williamson's⁴⁴ observations, and five in those of Seegen.⁴² Diabetic cataract may occur at any age. In youth there is rapid, bilateral development of soft cataract. In old patients the course is slower and less characteristic, in fact the lenticular opacity may be but a relative symptom of the accompanying general debility and senile degeneration. The premature development of cataract should always excite suspicion of diabetes.

Sometimes there is only a haziness of the vitreous and lens without gross fundus-changes; and this may be non-progressive or decrease as the case improves. W. O. Moore²⁹ reports a case in which floating bodies in the vitreous and peripheral opacities in the lens, in a diabetic woman of fifty, partially cleared with the diminution of glycosuria. Distance vision was 20/40 in each eye, but reading was only accomplished with great difficulty. The opacities became denser as the glycosuria increased, until the lens was quite cloudy. On the disappearance of the severe diabetic symptoms, the lens gradually cleared, although the vitreous opacities remained. The fundus appeared nor-

mal. The patient died three years later, without showing further changes in the intra-ocular media.

De Schweinitz⁴¹ cites an instance of a similar nature in a myopic woman of fifty, with 10 per cent. of sugar in the urine. Corrected vision was $6/7\frac{1}{2}$ and $6/9$. By the suitable changing of lenses, and rigid dietary precautions for nearly two years, the cataractous process was kept stationary. Later, after discontinuance of strict dietary restrictions while undergoing treatment in an institution for the absorptive treatment of cataract, there was rapid increase of opacity and subsequent extraction in Europe of two cataracts. Fuchs mentions the partial disappearance of lenticular opacities in diabetes after prompt and successful administration of the Carlsbad water cure. Nettle-ship³¹ goes further and says that diabetic cataract may disappear entirely, and he reports a case in which the lens completely cleared on the subsidence of severe diabetic symptoms. Seegen, Tannahill and Appenzeller report somewhat similar cases.

Keratitis and Iritis.—Keratitis is an uncommon complication. Leber, Schirmer,³⁰ Wiesinger,⁴⁴ Himly, Galezowski,¹⁹ Bellouard and others report cases, generally purulent in nature, with serious sequels such as leukoma adherens and phthisis bulbi. Schirmer advises testing for glycosuria in every case of intractable iritis. Iritis is a much dreaded complication of ocular operations in diabetes.

Retinitis.—As early as 1856, E. Jaeger reported a case of diabetic retinitis and published a drawing showing the ophthalmoscopic appearances. In 1858, Desmarres described two cases. In 1869, Noyes³³ gave a careful history of a case, positively excluding albuminuria. In 1879, Leber²⁵ had collected nineteen cases, and incorporated them in his classic article in the Graefe-Saemisch Handbuch. It is ordinarily supposed that retinitis is a rather common complication of diabetes. Lagrange²⁰ observed in fifty-two diabetic eye-cases, seventeen instances of retinitis, eleven being in pure diabetes. Leber is of the opinion that retinitis is a much less frequent complication than cataract and disease of the optic nerve. Galezowski¹⁹ has observed but twenty-seven cases of retinal changes (19 per cent. in 144 diabetic eye cases, while there were forty-six cataracts, 31 per cent.). One of the most recent writers, Williamson,⁴⁵ states that the frequency of retinitis is overestimated, and that "as a matter of fact true diabetic retinitis is rare."

Retinal changes are most often seen in patients past forty-five, as the vascular system is more susceptible to degeneration after middle life; although Culbertson has reported a case in a child of six. However, in this instance the diabetes was secondary to malaria, which must have already produced pronounced corpuscular and vascular changes.

Very often in diabetes there is co-existent albuminuria, and the retinitis assumes a mixed type, or a typical albuminuric retinitis only may be present. Hirschberg¹⁸ reported twenty-four cases of diabetic retinitis, fifteen of which were uncomplicated with albuminuria; while of the seven cases of retinitis observed by Williamson in one hundred diabetics, only two were free from albuminuria. Schweigger is of the opinion that no distinct type of retinitis is associated with diabetes; but according to Hirschberg and many others, a common form is central punctate retinitis, a characteristic inflammation in the macular region, with small bright spots and usually with small hemorrhages. Among other forms are the purely hemorrhagic, having serious prognostic significance, and cases resembling retinitis pigmentosa.

In pure diabetic retinitis there is no papillitis, although the cases are generally followed by optic atrophy, due to nutritional disturbance or hemorrhage in the nerve-sheath. According to Galezowski,¹⁹ glycosuric retinitis is frequently unilateral, a rare occurrence in syphilitic and albuminuric retinitis. Often the points of difference are not well marked, and only an examination of the urine will decide the diagnosis. The principal differences between diabetic and albuminuric retinitis have been tabulated by Dodd⁹ as follows:

DIABETIC RETINITIS.

1. Groups of bright glancing spots in the retina, irregular in outline, usually in the central part, but frequently affecting the whole of the fundus.
2. If the spots are larger there still exist small dots and lines, and they never run together.
3. The arteries and veins are not much changed in appearance.
4. The optic nerve is either not affected or atrophic.
5. The retina is not diffusely affected.

ALBUMINURIC RETINITIS.

1. At first a group of bright bluish-white spots in the center of the retina, often forming a stellate patch about the macula.
2. The spots may run together and involve all of the central part of the retina.
3. The arteries are narrowed, the veins large and irregular.
4. The optic nerve is swollen and its outline indistinct.
5. The retina is infiltrated.

Central Amblyopia.—It has been assumed that the toxins in the blood incident to the metabolic disturbance of glycosuria, may cause primary optic neuritis as well as inflammation of other nerve tissue, for instance, sciatica. However, clinical observation shows that although there may be optic atrophy, primary, or the result of denutrition or hemorrhage into the nerve-sheath, there is rarely, if ever, true optic neuritis in diabetes uncomplicated with albuminuria. In some of

the earlier cases of diabetic amblyopia without ophthalmoscopic evidences, attributed to primary optic nerve disease, the cause was likely a cerebral lesion. This was an explanation given by von Graefe, and it is particularly applicable to the few recorded instances of hemianopia in diabetes.

As early as 1861, Lecorché²⁷ made a thorough review of the subject of diabetic amblyopia without gross fundus-changes, and implied that at autopsy the probable cause would be found in degeneration of the optic nerve occurring independent of cerebral disease. This has been fully confirmed by subsequent observers. Leber found in fifty diabetic eye cases, evidences of optic nerve disturbance in 28 per cent. Schmidt-Rimpler²⁸ found thirty-four patients with optic nerve disease among 140 diabetics with ocular disorders.

There are many instances of minor amblyopia with glycosuria reported. There may be only an unaccountable dimness of vision, especially in reading, uncorrected by lenses, with perhaps flickering sensations and photophobia. If these cases are seen before an actual ocular lesion has occurred, and the proper treatment is instituted, the visual disturbance may entirely disappear. In such patients improvement is noted after prolonged rest and they are made worse by exercise, fatigue and intense illumination. Sudden and violent movements or any other cause of accelerated cardiac action or increased vascular tension will increase the scotoma.

I have seen a case in which unaccountable sudden failure in the vision of the right eye to 6/20, with a very relative central scotoma particularly for red and green, in an overworked and neurasthenic professional man of twenty-nine, first led to a urine analysis. Marked glycosuria was discovered, and rigid hygienic, dietetic and medicinal treatment was instituted, with the prompt disappearance of glycosuria and recovery of full acuity of vision (6/5) within six weeks. The patient was a myope of four diopters. There has been no recurrence of glycosuria or visual disturbance for over one year, although the patient has long since resumed the ordinary mixed diet, but has been more observant of personal hygiene and has avoided mental and physical fatigue. There was no history of excessive use of tobacco or alcohol, and neither substance was interdicted in the very moderate amounts commonly used. The patient was carefully examined by three competent oculists, none of whom could detect pathological fundus-change. The visual disturbance was quite variable, and seemed to increase on the slightest cardiac acceleration. On one occasion, when the patient had stayed so long in a steam-box at a bathing establishment that he had "throbbing at the temples," the scotoma became temporarily absolute.

Such cases prove conclusively that there is at first no distinct organic change in the intra-ocular tissues. De Schweinitz⁴⁰ believes that there is only a vascular disturbance or transient edema causing pressure on the macular fibers. In support of this, he cites an instance reported by Silcock and Broadbent in which they observed the disappearance of a scotoma in diabetic amblyopia when, under the influence of nitroglycerine, a previously high arterial tension was lowered to normal. Even though a definite retinal lesion has occurred, it may cause only partial degeneration of the retinal nerve cells and may be nonprogressive. In such case it is not unreasonable to assume that there may be recovery of the visual function. Recent experimental researches by Goldscheider and Flattau, seem to prove that degenerated ganglionic cells may regain their healthy structure. In this connection the following quotation from an editorial on the prognosis of nerve disease in *American Medicine*, February 22, 1902, has a direct application:

"If a lesion is nonprogressing, restoration of function will depend upon 'recovery of nerve tissue which is only partially damaged, or the taking up by adjacent or distant structures of the functions that are lost.' Bury quotes Dr. Mott as stating that nerve cells or fibers in the brain or cord when completely destroyed can never be replaced by new cells or fibers. He also quotes Marinesco and Lugaro with regard to the pathological significance of lesions in different parts of a nerve cell, the former stating that lesions of the chromatic part are the first to appear where the harmful action does not act suddenly and with such energy as to paralyze function, and that these can be recovered from, provided other parts of the cells have not suffered serious damage."

There is a more marked and permanent form of amblyopia associated with glycosuria, in which, though the fields of vision may not be decreased, there is a central scotoma, particularly for red and green and sometimes blue. In pronounced cases the scotoma may extend from the center outward to beyond the blind spot. On the other hand, it may be paracentral, very small and relative, and difficult to detect. It may cause instability of ocular fixation, or perhaps slight nystagmus on concentration of vision.

The condition is analogous to the amblyopia due to the excessive use of tobacco or alcoholic beverages, or the ingestion of such poisonous substances as methyl alcohol. Galezowski¹⁶ was one of the first to diagnose diabetic amblyopia by urine examination, and he remarked that while in ordinary amblyopia ex abusu both eyes were usually affected, in that due to glycosuria one eye may escape. This point has lacked confirmation by the majority of observers, although in the case seen by me the right eye only was affected.

It is rather difficult to exclude the influence of tobacco and alcohol, as most patients use these substances to some degree, and in the debilitated state of diabetes there is particular susceptibility to toxic influences. There is, however, no doubt of the occurrence of cases of amblyopia purely the result of the toxemia incident to glycosuria. Nettleship,⁸¹ Samuel⁸⁷ and Moore²⁹ report cases in women who used neither alcohol nor tobacco, and Eales¹¹ and Schmidt-Rimpler³⁸ mention cases in men who did not smoke. Most of the patients are past forty years, although Bresgen,⁴ Schmidt-Rimpler and Edmunds and Lawford¹² have reported cases in men between twenty and thirty. In my case the patient was under thirty.

The amblyopia may appear suddenly, progress, remain stationary or disappear, according to the progress of the causative condition. It must not be confounded with the sudden amblyopia in the course of diabetes, due to poisoning of cerebral centers of vision, as in uremia, which condition is likely to presage an attack of diabetic coma.

The loss of vision is by no means always permanent. As early as 1858, Desmarres⁶ records the case of a man of twenty-five, with pronounced glycosuria, whose sight had failed so that he could neither read nor write. After seven months' treatment, his health improved and vision was so far recovered that he could read Jaeger, No. 8 type. Leber reports the case of a man of forty-three, whose urine contained sugar but no albumin. The vision of the right eye was $1/2$. In the left eye, the inner half of the field was almost absent, with only the recognition of shadows at five feet in the outer central and temporal fields. With improvement of general health, there was much recovery of vision although a central scotoma persisted. On examination four years later, vision was found the same. No ophthalmoscopic changes were visible. Galezowski records an instance in a French army officer of forty-eight, whose fields were greatly contracted and who could not recognize faces at nine feet. There was no visible fundus-disease. With improvement of general health there was a corresponding increase of visual acuity. Later albuminuria developed. Seegen mentions a somewhat similar case.

On the other hand, Bresgen⁴ in 1881, reported a case of diabetic amblyopia in a man of twenty-four, in which aggravation of the diabetic symptoms caused an increase of the color scotoma, and a diminution of vision from 20/200 to 2/200. Moore²⁹ records several similar observations, in one of which the vision remained stationary. The patient was a married woman of forty-nine, who had suffered with diabetes for six months, passing 150 ounces of urine daily with marked glycosuria. There was a sudden failure of vision to 20/200, without ophthalmoscopic change of note, and no limitation of the visual fields,

but central scotoma for red and green. The vision remained the same until death two years later. No autopsy was recorded.

There are on record undoubted cases of mixed amblyopia. Leber reports a case in a man of fifty, who had central scotoma for colors, but no contraction of fields or ophthalmoscopic changes, with vision of 20/70. The case was treated as one of tobacco amblyopia and vision improved to 20/30 in each eye. However, two months later, the vision of the right eye fell to 20/200. Glycosuria was discovered and anti-diabetic treatment instituted, with recovery of vision.

There are numerous descriptions of autopsies and microscopical examinations of the optic nerves in these cases, notably by Nettleship,³¹ Edmunds,³² Sachs,³⁴ Samelsohn, Unthoff, Vossius, de Schweinitz⁴¹ and Deutschmann.⁷ From the findings we are led to infer that there has been a retrobulbar neuritis with subsequent atrophy of the "papillomacular fibers" (Henschen) of the optic nerve, appearing on cross-section as a wedge-shaped area of degeneration in the temporal half of the nerve. Longitudinal sections may not show changes anterior to the lamina cribrosa, but posterior, in the temporal half will be a well-marked tract of degeneration, with atrophic nerve fibers, increase of nuclei and connective tissue and thickened trabeculae and blood-vessel walls. The vascular changes are most marked in front of the point of entrance of the central retinal artery (Nettleship). There are clinical reasons to believe that in these cases the disease of the optic nerve rarely, if ever, extends beyond the "papillomacular fibers."

With the advent of the modern stains for ganglion cells and improved pathological technique, the initial lesion in some cases of toxic amblyopia has been located in the peripheral neurons of the retina. This was suspected as long ago as 1874, by Schoen, and later by Treitel and Baer. It has recently been demonstrated by Nuel,³⁴ Usher and Dean,⁴³ Holden, Birch-Hirschfeld, Griffith and others that the ganglion cells of the macular region were the first at fault, and that the neuritic changes were secondary to the retinal disease. These facts and the knowledge that diseased ganglion cells may regain their normal structure, furnish an explanation of the improvement of vision in some cases of profound toxic amblyopia, even when due to so virulent a poison as methyl alcohol. With more careful ophthalmoscopic examination, doubtless in many cases formerly described as without evidences of disease in the fundus oculi, there would likely be noticed slight vascular and connective tissue changes in the nerve head, undoubtedly pathological; and perhaps later, pallor of the temporal half of the disc.

The prognosis of glycosuric amblyopia is dependent on the constitutional condition. If the visual disturbance occurs early in the

disease in mild cases, it may lead to the discovery of glycosuria, and under proper treatment both the vision and general health may be restored. In cases of pronounced diabetes the patients grow worse steadily in spite of the most vigorous treatment, and the failing vision remains stationary or proceeds to blindness. In all cases of diabetic amblyopia in which the central scotoma is absolute, the prognosis as to recovery of useful vision is very doubtful.

SUMMARY.

1. Diabetes mellitus or other disturbance of the carbohydrate metabolism may affect any portion of the visual apparatus.

2. The ocular changes may be produced by chemical or physical means, or indirectly through the associate general debility.

3. The ocular affections may vary in intensity from a slight failure of accommodation to a formidable hemorrhagic retinitis and total optic nerve atrophy. Minor visual disturbances are often made worse by fatigue or increased cardiac action, and may improve after prolonged rest or decrease of vascular tension.

4. The intra-ocular disturbances may be exclusively unilateral, and there is never seen, ophthalmoscopically, inflammation of the optic nerve—important differences from the changes in albuminuria, syphilis and other blood dyscrasias.

5. It is not uncommon to find albuminuria co-existent with glycosuria, and the retinal changes may present a mixed picture, or a typical albuminuric retinitis may be present in a patient with diabetes.

6. Central amblyopia may exist in glycosuria entirely independent of the toxic influence of alcohol and tobacco, or in patients addicted to the habitual use of these substances this may be the prominent factor in causation. In these cases the initial lesion may be in the ganglion cells of the retina, and the inflammation in the "papillo-macular fibers" of the temporal half of the optic nerve may be secondary to the retinal changes.

7. In chronic cases of glycosuria, with the exception of cataract, the ocular symptoms are often present when the constitutional and urinary symptoms are not marked.

8. The ocular symptoms may be the first to lead the patient to seek medical advice. Therefore, glycosuria should be suspected in the following conditions: (a) Premature presbyopia; (b) unexplained mydriasis or cycloplegia; (c) sudden change in the refraction; particularly, marked development or increase of myopia past middle age, without cataractous changes; (d) intractable iritis; (e) cataract in young or middle-aged persons. An examination of the urine is advis-

able even in cases of senile cataract, as the etiology has a bearing on the prognosis of operation. (*f*) Retinitis, particularly of the hemorrhagic variety; (*g*) unexplained optic nerve atrophy; (*h*) sudden and marked amblyopia, particularly central, without visible fundus-changes.

9. The prognostic significance of the ocular disturbances is not definitely established, on account of the great differences in pathogenesis, severity and ultimate issue of the numerous forms of glycosuria. Even in well-marked cases not only may formidable eye lesions improve, but the patient's general health may be restored. Again, the ocular symptoms may remain stationary and the general health improve, or a case of diabetes mellitus may proceed rapidly to a fatal termination without showing marked ocular disturbances. Hemorrhagic retinitis and amaurosis preliminary to coma are the most serious symptoms. The ophthalmoscopic observation of greatest value in prognosis is the state of the retinal vessels, as this may be taken as the index of the patient's general vascular condition.

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DISCUSSION.

DR. PACKARD said that one of the most interesting questions was the relation between alimentary glycosuria and true diabetes mellitus. It seemed to the speaker that certainly in a large number of cases alimentary glycosuria was a warning of the possible occurrence of diabetes mellitus, holding in this respect somewhat the same relation that goutiness held to gout. There are undoubtedly many persons with unstable glucose assimilation who could easily topple over into true diabetes mellitus, and yet these patients do not deserve the title of diabetics. In regard to the term diabetes, the speaker believed that there was too much laxity in its use, and that it was eminently improper to speak of diabetes temporarily following the use of a drug simply because the administration of that drug caused the appearance in the urine of glucose or other reducing substances. Glycosuria is not diabetes, but is only one of the many symptoms of that condition. While realizing that reports of individual cases are seldom of either profit or interest during discussion, Dr. Packard mentioned one case which seemed to have such a striking bearing upon the question of where the term glycosuria became inadequate that he considered it worthy of mention. An Englishman, aged 45 years, weighing 250 pounds, had consulted him, complaining that he had lost 29 pounds in 23 days. The chief interest was that for 2 or 3 weeks previous to his notice of his failing weight, the man had consumed tremendous quantities of ginger ale, as many as 6 bottles in an hour and in 4 days 4 dozen bottles. It was a question whether the large amount of ginger ale was responsible for the large quantity of sugar in the urine, amounting to 23 grains of glucose to the ounce. On a moderately restricted diet there was rapid recovery. In 11 days the sugar fell to 11 grains to the ounce, a week later 2 grains, and in the following week in from 32 to 48 ounces of urine there was no sugar. The man had gained 5 1-2 pounds. Repeated examinations showed no sugar. The case was regarded as one of alimentary glycosuria. Efforts to ascertain the character of the sugar contained in the ginger ale had been unsuccessful. By January of the following year, 1892, the man had regained his former weight. He was next seen in 1894 when he had again lost 20 pounds in 6 weeks. He had not at this time been taking ginger ale. From that time until his disappearance from observation he had

constantly had small quantities of sugar. Nothing further had been heard from the patient except that from other sources Dr. Packard knew that the man had recovered sufficiently to go on a prolonged spree and give the authorities in England considerable trouble. One of the curious things about diabetes mellitus, Dr. Packard stated, is that in cirrhosis of the liver and acute yellow atrophy of the liver in which the glycogen storehouse is destroyed, glycosuria is infrequent. It seems peculiar that in cirrhosis of the liver there should be no glycosuria, because the venous circulation is so seriously interfered with and is only preserved by collateral anastomosis, while the hepatic cells must be presumed to have a lessened ability to convert and store glycogen if only because of their lessened number. Mention was made of the epoch-making work of Opie in describing the degeneration of the islands of Langerhans in the pancreas. The important diagnostic symptoms mentioned by Dr. Edsall were referred to and those of gingivitis and the absence of knee jerks emphasized. In hospital and private work the urine should always be examined. In dispensary work, while theoretically right, practically this was out of the question, and in these instances these accessory signs are regarded as valuable. The accumulation of a little white secretion at the inner canthus of the eye, noticed by Dr. Packard in a number of cases of diabetes mellitus, had caused him to find glucose in the urine of dispensary patients who otherwise might have escaped without urinary examination. The presence of Kussmaul's air hunger, or the presence of a small area of gangrene of peripheral portions of the body were also causes for examination of the urine. Theoretically, of course, we should examine the urine of all dispensary patients, practically this is impossible in most large clinics. In prognosis he considered the disease one of the most difficult. A few years ago he had given the most gloomy prognosis possible in a case of diabetes mellitus, because the man had not only albumin and sugar, but upon examination for a couple of weeks had acetone and a tremendous increase of casts. At present the man was doing well with a slight albuminuria and with glucose almost nil. In treatment reference was made to the general understanding that certain articles, such as cranberries, could safely be given to a diabetic. He thought it should be borne in mind that the harmful quality of cranberries and some other articles for the diabetic results from the large amount of sugar used in their preparation for the table. The same is true of rhubarb and other products of the garden. The chemical composition of the food in the raw state makes less difference than does its composition when served on the table. Reference was made to the statement of Kleen that diabetes had been observed congenitally and glucose found in the amniotic fluid, which he says is the urine of the child.

DR. JUDSON DALAND said that in testing for sugar in the urine he had been in the habit of using Fehling's method and fermentation. Several years ago he had made comparative observations between Fehling's method, the fermentation test and the use of the polariscope. These experiments showed that in ordinary work the fermentation test gives rather the better results, especially if the urinometer is employed, and the temperature allowed to reach 70° F. The few cases that Dr. Daland had seen of diabetes mellitus had followed the usual rule of showing a quick fatality. The majority of the

cases encountered by him in the last 15 years had been in men at or after middle age, and of these the greater number had not shown the typical or even the subsidiary symptoms of the disease. Dr. Daland agreed with Dr. Packard that many of the cases that are ready to topple into diabetes, are cases that may be recognized early and, if held in restraint, and the ordinary treatment adopted, might be saved from terminating as diabetics. The association of food stuffs with diabetes he thought most beautifully shown by Dr. Edsall in his former contributions. He agreed with Dr. Packard in his remarks concerning food. He had made some examinations of grapes and also of a certain kind of very palatable jelly which was supposed to be entirely free from sugar but which contained more than 30%. In treatment Dr. Daland had found in the cases of alimentary diabetes the best results follow careful supervision of the diet. His experience with diabetic coma had been unfortunate; the various remedies, including transfusion with salt solution had been without avail.

DR. LOUIS JURIST said that he entered practice with the belief that every patient who had sugar in his urine was going to die and die quickly. To-day he is so much confused concerning the prognosis of diabetes mellitus, that he always says the patient will do very well. He has seen sugar in the urine of children of 5 and 6 years. A certain number of diabetics are dyspeptics. Patients in whom long continued digestive disturbance of indistinct character is accompanied by neurotic conditions and itching need careful observation. In 3 women this combination of symptoms was present over a period of 3 or 4 years, the itching affecting the vulva. These women were repeatedly examined by gynecologists, but a correct diagnosis was not made until glycosuria developed. He always encourages his patients to go on dietary sprees. He keeps the patients rigidly, but when they grow impatient he tells them to go away for a week and to eat anything, but not to drink alcoholic liquors. They then come back to the diet with a certain amount of patience. In regard to the existence of diabetes among the Jews, reference was made to Oppenheimer's work on the Nervous System in which is mentioned the predisposition of the Hebrew, as well as the Frenchman to hysteria and functional nervous disorders. After considerable experience among the Hebrews he believes that there are several contributory factors to these lesions: the intensification of all weaknesses by intermarriage; the present ability to gratify tastes that formerly their surrounding conditions did not permit to be indulged; and their decided tendency to sedentary life. Diabetes, complex as it is, seems likely to develop under such conditions.

DR. ROBERT N. WILLSON referred to a case in which he had examined the urine for a month before glycosuria was seen. The patient was 73 years of age and had had an old and serious nephritis for several years. There was a sudden uremic attack with coma, and an increase of all the symptoms ending in death. Examination of the urine at 7 A. M. showed albumin, granular casts and renal epithelium, but no sugar. At noon there was nearly 6% of sugar, a higher specific gravity than in the morning, a large quantity of urea, less albumin and less renal sediment. In the urine obtained by catheter after death, on the same day, there was no sugar present, the urea was again low, as was also the specific gravity. A possible explanation, Dr.

Willson thought, lay in pressure upon the floor of the fourth ventricle, and could be ascribed to variations in the intracranial pressure due to local transient edema or other cause.

DR. A. A. ESHNER said that while the present conception of diabetes mellitus considers it a general derangement of carbohydrate metabolism, of which glycosuria is the most prominent symptom, a recent experience of his own in conjunction with that related by Dr. Willson raised the question in his mind whether there might not occur a similar train of general symptoms, with wasting, increased appetite and thirst, and perhaps other manifestations, but with an absence of glycosuria. He was unable to judge whether under such circumstances glycosuria might be absent for long periods at a time, but it seemed to him that there might be present the metabolic derangement without necessarily the constant presence of sugar in the urine. Regarding racial predisposition to diabetes, he believed that the Hindoos have even a higher morbidity than the Jews. This seemed to him a peculiarity due, not so much to diet, but to race pure and simple, and that behind this might be the constitution of the nervous system. He believed the problem a large one, and that there could be no doubt that the nervous system played a significant role in the etiology of diabetes, even if it did so only through its influence upon organic function.

DR. WALTER L. PYLE, in his closing remarks, added that Culbertson had observed diabetic retinitis in a child of 6. There was in this case, however, a previous history of malaria which had produced profound corpuscular and vascular changes. In regard to diagnosis, Kleen, he said, had stated that he was almost prepared to give a negative diagnosis in cases of suspected diabetes if the teeth were found in good condition. His first observations in the examination for suspected diabetes are directed to the patient's mouth. Referring to the influence of the pancreas in glycolysis he described the experiments of Lépine and his French coworkers. He hoped that in closing Dr. Edsall would speak of the present tendency toward a greater liberality in diet in diabetes particularly with regard to potatoes and milk. In the so-called "potato-cure," it is claimed that the potato contains certain salts very necessary to the human economy. In regard to prognosis reference was made to Naunyn's statement that fatal cases are easily recognized from the first, while admittedly mild cases always remain benign. The relation of eye-symptoms in prognosis, Dr. Pyle did not think had the same bearing as in albuminuria. Some fatal cases may not show any ocular symptoms while in others of a mild type ocular lesions may occur and remain permanent, even though the patient recovers general health. The most important suggestion in prognosis is found in the condition of the intra-ocular bloodvessels.

DR. EDSALL, in closing the discussion, said that he thought that too much stress was laid upon the importance of the occurrence of albumin in the urine in diabetes. As a rule, it means nothing more than an irritation of the kidneys, which does not become accompanied by the other signs necessary in making a diagnosis of nephritis. The albuminuria is almost certainly due to the passage through the kidneys of large quantities of sugar and of the products of protein metabolism,—the latter, of course, being passed in excessive amounts, because diabetics necessarily take large quantities of

protein. Albuminuria alone is insufficient for a diagnosis of nephritis. As to the association of diabetes with disease of the liver, Dr. Edsall felt that there was a tendency to attribute too great an importance to the liver in the storage and metabolism of carbohydrates. It must be remembered that the muscles are quite as much to be considered as the liver in this connection, and that the muscles can probably substitute for the function of the liver in very great degree—possibly entirely. A greater importance is very justly placed upon the function of the pancreas. It is impossible to bring the latter organ into direct analogy with the liver; for apparently nothing can take the place of the pancreas. The presence of casts in the urine is of importance in relation to the possible onset of diabetic coma only when these casts appear suddenly, in considerable numbers, while previously they have been almost or quite absent. Personally, Dr. Edsall was inclined to believe that estimation of the sugar by means of fermentation methods would always be decidedly inaccurate, and useful only for comparatively rough clinical purposes. The experiments of Lépine and his collaborators cannot be considered at all satisfactory. The question of the existence of a glycolytic ferment has recently been briefly but concisely gone over by Bendix and Bickel, and they have demonstrated that the errors connected with the methods of work are such as to make all apparent demonstrations of such a ferment subject to extreme doubt. The teaching concerning the glycolytic ferment is really resting upon no sounder basis than the very premature theory put forth, a few years ago, by Leo, who believed that he had demonstrated that diabetes is due to an intoxication—his only proof being that the injection of diabetic urine caused glycosuria in dogs. As to diet, Dr. Edsall felt that everyone was of the opinion that the diet should be decidedly more free than formerly was thought to be proper.

The Significance and Diagnosis of Various Forms of Hematuria.

BY H. M. CHRISTIAN, M. D.

[Read April 9.]

Leaving out of consideration those cases of hematuria dependent upon organic disease of the kidney substance, either acute or chronic, as well as those occurring in tropical regions, produced by either the malarial organism or the presence of the filaria, the appearance of blood during urination or in the urine itself must be taken as symptomatic of some severe surgical condition in the genito-urinary tract. Harris, however, quoted in Lydston's text-book on genito-urinary diseases, reports the histories of eighteen cases of apparent idiopathic hematuria, regarding which he makes the following statements:

1. "There is a condition of renal hematuria not due to the usually accepted causes.

2. "There is probably in these cases a local lesion in the kidney which may be strongly influenced by the nervous system.

3. "With our present knowledge we are unable to state what the pathological changes are."

Notwithstanding these well-authenticated reports, which we feel must be considered as rather exceptional instances, it is still fairly safe to assume that the large majority of cases of hematuria are directly due to lesions in the genito-urinary tract, congestive, inflammatory or mechanical in character, produced by the presence of foreign bodies or tumors. It is found to occur in one of three forms: (1) initial hematuria; (2) terminal; (3) blood intermingled with the urine.

In initial hematuria the blood appears either fluid or in clots before the urine begins to pass, and is succeeded by a flow of clear urine. The two-glass test shows the first glass to contain bloody urine, the second being perfectly clear.

Under such circumstances the lesion is clearly indicated as being present in the urethra, and will be found to be due to either traumatism such as occurs after improper instrumentation, the presence of a granular stricture or papillomatous growth or an impacted urethral calculus.

In terminal hematuria, on the other hand, the blood appears at the close of urination and is always preceded by a clear or cloudy (generally cloudy) urine. The two-glass test shows the first glass to be clear or cloudy and the second bloody. The blood in terminal hematuria may vary in amount from a few drops to a dram or two.

The writer has in mind a case of turpentine poisoning seen in his practice, in which absolutely clear urine was voided, each act being followed by the passage of fully three drams of pure blood.

Terminal hematuria is observed as a result of pathological conditions limited solely to the posterior urethra or trigone of the bladder. These lesions may be congestive in character, such as result in cantharides and turpentine poisoning, or inflammatory, the result of acute posterior urethritis, urethrocystitis complicating gonorrhea, or tubercular deposit at the vesical neck. Blood at the close of urination is occasionally observed in cases of vesical calculus, but is by no means a constant symptom of this affection.

When blood appears in the urine alone, as determined by the microscope or the color of the urine, or the appearance of clots, the source of the hemorrhage will be found in either the bladder, ureter or kidney. The exciting causes are inflammatory, as cystitis and tuberculosis; mechanical, as in calculus; or organic, as in tumor, either benign or malignant. As a rule—to which, of course, there are excep-

tions—when the source of the hemorrhage is the bladder alone, the urine will be alkaline, and will appear dark-red or claret-colored to the eye.

This is particularly the case in many instances of vesical calculus, and in all cases of papillomatous growth in the bladder. On the other hand, in cases in which the blood is dependent upon lesions in the kidney or ureter, such as impacted calculus or tuberculosis, the urine will generally be found acid in reaction and of a smoky hue.

In order to determine definitely the causes operating to produce hematuria, it is essential in all cases to note the form in which it occurs. In initial hematuria attention need be paid to the anterior urethra alone. The history of the case will reveal whether there has been any recent traumatism or rough instrumentation. Examination of the urethra will still further demonstrate the presence of a stricture or impacted calculus. Terminal hematuria can be regarded as almost pathognomonic of acute posterior urethritis, urethrocystitis or tuberculosis of the trigone. In the great majority of cases there will be a history of gonorrhea either acute or chronic, which will definitely determine the nature of the case. Terminal hematuria appearing without any history of recent gonorrhea, associated with some increased frequency of urination, is to the writer very significant of tubercular deposit about the neck of the bladder. To arrive at an accurate diagnosis as to the source of the blood in the third variety of hematuria is oftentimes a most difficult problem. First of all, investigation should be made to ascertain, if possible, whether the blood is from the bladder or the kidney. In this regard the points just mentioned concerning the reaction and appearance of the urine may prove of some service. Again, where the bladder is affected, there is more or less vesical irritability, as shown by increased urinary frequency, an exception to this occurring in cases where the lesion occupies the fundus of the bladder.

On the other hand, where the hematuria depends upon either impacted ureteral calculus, stone in the kidney or tuberculosis or malignant tumor of the kidney, it will always be accompanied with severe pain located over the lumbar region on the affected side, such pain being absent in cases in which the bladder alone is involved. At the very best the problem of determining the source of the hematuria is in many cases a difficult one to solve. At first thought it would seem as if the cystoscope ought to offer the best aid in arriving at an accurate diagnosis; as a matter of fact it has often proved most unsatisfactory, owing to the inability to get a clear refracting medium and to keep it clear. For this purpose the writer has found the irrigating Nitze-Albarran cystoscope the most serviceable of any. By it one is able to

secure a tolerably clear medium, and any blood issuing from either ureteral orifice can be easily distinguished. Dr. W. K. Otis has called attention to a rather ingenious method for determining the source of the blood in the urine; one that has not received the attention that it should, but which the writer has found on two occasions to be of considerable value.

The bladder, after being washed out with a boric acid solution, is filled with about eight or ten ounces of a one per cent. solution of potassium iodide in distilled water. At the end of fifteen minutes the patient is requested to expectorate in a cup, the sputum being at once tested with a starch solution for the presence of iodine. If there has been absorption of iodine, as shown by the starch reaction, it has occurred through a damaged vesical mucous membrane, this fact demonstrating the bladder as the seat of the hemorrhage.

In the vast majority of cases hemorrhage from the bladder denotes: (1) vesical calculus; (2) new growths; (3) ulceration resulting from chronic cystitis or vesical tuberculosis.

Concerning new growths in the bladder, they are for the most part papillomata, the hemorrhage from which presents three peculiar distinguishing features: (1) sudden causeless onset; (2) profuse amount; (3) sudden cessation.

Hemorrhage from the kidney in most instances, excluding acute nephritis, indicates either calculus or tuberculosis. The X-ray is considered at the present day to be of the greatest service in detecting calculi, either in the kidney or ureter. Regarding genito-urinary tuberculosis as a cause of hematuria, the diagnosis must in most cases be determined by the process of exclusion, as at present we have but few signs pointing definitely to the existence of this affection.

DISCUSSION.

DR. ORVILLE HORWITZ said that it is well-known that the brighter the blood, the more arterial it is in character, the nearer the source of hemorrhage is to the meatus. When the blood is of dark color and intimately mixed with the urine, the source of the hemorrhage is probably renal. If, however, hemorrhage from the kidney is profuse and the intervals between the acts of micturition of short duration, the blood and urine do not have time to mix and consequently the urine passed will be of a bright red color. Hemorrhage from the urethra, between the acts of micturition, usually means a hemorrhage from the anterior portion of the canal. Blood preceding urination usually means hemorrhage from the prostatic urethra; especially is this true if there is a history of inflammation of the urethra, there being no symptoms referable to either the bladder or kidney. Terminal hematuria, especially if associated with inflammatory symptoms, such as pain, spasm and frequent urination, means hemorrhage from the posterior portion of the canal or neck of the

bladder. Blood appearing in the urine after injury to the loin is significant of injury to the kidney. A profuse hemorrhage following a blow in the suprapubic region generally indicates an extraperitoneal rupture of the bladder, whilst, according to Beck, if the amount of bleeding is scanty, the injury to the viscus is apt to be intraperitoneal. The shape and appearance of the blood clot in the vessel after the urine is voided is often very significant. Large, irregular, fleshy clots are usually of bladder origin; especially if disease or injury of the kidneys can be excluded. Long, thin clots, the shape of earth worms, mean hemorrhage from the renal pelvis. This characteristically shaped clot is often absent in cases of hemorrhage from the kidney. V. Jaksch claims that when the urine is intimately mixed with the blood and allowed to stand in a conical glass, if the source of the hemorrhage is renal or ureteral, that the formation of a sediment will be delayed for several hours. The condition of fibrinuria described by Ultzmann is of very infrequent occurrence. Dr. Horwitz stated that in numerous cases of papilloma of the bladder which had come under his observation, he had never met with a condition of the kind. This experience coincides with that of Hurry Fenwick, who states that "Out of 100 cases of vesical growths he has never met with it in a single instance." Hemorrhage from the ureter is associated only with the passage of stone. When the source of the hemorrhage is from the seminal vesicles, the amount of blood lost is slight and is associated with a seminal discharge. In discriminating between vesical and renal hemorrhage, the clinical history will be of the greatest aid in assisting the surgeon to arrive at a definite conclusion as to the source of the bleeding. It must not be forgotten that the test spoken of, that of locating the origin of the hemorrhage by the character of the bloody urine, is a very crude one; as a diseased bladder, in which urine and blood is thoroughly mixed, will have a dark color; on the other hand, as has already been stated, the blood which comes in large quantities from an injured or diseased kidney may be bright red in color. The potassium iodide test, suggested by Dr. W. K. Otis, of New York, for determining the source of bladder hemorrhage is a very crude method of arriving at a diagnosis and is not to be employed except in those cases in which a cystoscopic examination is not permitted. The presence of the eggs of the *Bilharzia hematobia* discovered in the urine by microscopical examination usually means hemorrhage from the bladder. It is often impossible to determine definitely the source of hemorrhage from any particular portion of the genito-urinary tract without employing special instruments designed for that purpose. This fact was illustrated by the following cases: A man 30 years of age, gave a history of 2 attacks of gonorrhea sometime before coming under observation; he complained of constant burning in the urethra during micturition, often followed by the passage of blood. There was a slight urethral discharge which was mucopurulent in character. By means of the Swinbourn posterior urethroscope a large papilloma was discovered situated in the vicinity of the bulbous urethra. The second case was that of a child, 11 years of age, who gave a history of having first passed blood in the urine 2 years before coming under Dr. Horwitz's care. Patient had had 2 similar attacks. The bleeding lasted about 4 days and was quite profuse. During the intervals the child was apparently in perfect

health. When first seen, the urine was amber colored, contained a slight amount of epithelium and a few pus cells. Cystoscopic examination revealed a large villous papilloma situated far back on the basfond of the bladder. The following case of hematuria was cited as being one of unusual interest. A man, 61 years of age, enjoyed good health up to 3 years before coming under Dr. Horwitz's care. He gave a history of frequent urination with at times a passage of a large amount of blood with the urine. Sometimes the blood would be dark, and at others, scarlet in color. Cystoscopic examination showed a large villous growth on the left wall of the bladder. Operation refused. Some months later an attack of retention of the urine followed the formation of a blood clot. It was found impossible to empty the viscus by the usual means. Operation was again refused. A small Thompson's lithotrite was inserted and an effort made to disintegrate the clot and remove it by means of a Biglow evacuator. This was finally successful and the bladder was emptied. Twenty-four hours later the patient began to pass fragments of the tumor with each act of micturition. This continued off and on for at least 2 weeks, since which time all symptoms referable to his vesical tumors have disappeared. Two years have elapsed since the attack of retention of the urine. There has been no further hemorrhage and the patient enjoys perfect health. It is evident that in this case in attempting to break up the clots by means of a lithotrite that the tumor was grasped in the jaws of the instrument and crushed; ultimately sloughing took place and a cure resulted. After convalescence another cystoscopic examination was not permitted. The irrigating cystoscope of Heynemann, of Leipsic, was exhibited. This was recommended as the most satisfactory instrument that could be employed for diagnostic purposes in cases of hematuria of any that had so far been devised. A case was reported in which the hemorrhage from a carcinoma of the left kidney was so profuse and uncontrollable that an immediate nephrotomy had to be performed. Several cases of so-called essential hematuria, which had come under the observation of the speaker, were cited. In one of these an incipient tuberculous involvement of the kidney was suspected. A cystoscopic examination showed the bladder to be normal. Urine negative. No reaction to the tuberculin test. In these cases the cause of the bleeding could not be determined.

Abstract of an Analysis of Fifty-two Cases of Tetanus Following Vaccinia : with Reference to the Source of Infection.*

BY ROBERT N. WILLSON, M. D.

[Read April 23.]

This analysis of a large number of instances of tetanus in the course of or following vaccinia was prompted by the occurrence of a case in the practice of the writer and by its fatal termination in spite

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of an early diagnosis and heroic treatment. During the five months that have succeeded the report of this case before the Philadelphia County Medical Society an attempt has been made to ascertain the details of such a number of similar cases as would warrant a conclusion as to the source of the tetanus infection. In the accompanying statement of cases are shown the main points in the case-histories all of which have been published in full at an earlier date. There is abundant indication that tetanus has occasionally appeared in the course of and following vaccinia from the time of Jenner down to the present day, and it will be noted that the cases included in this paper date back as far as 1839.

The object of the analysis of these cases is to prove:

1. The source of the tetanus infection; whether the virus or some other medium.

2. The time of the infection; whether synchronous with the vaccination, or subsequent to it.

3. If a secondary infection (not carried by the virus); then due to what circumstances, and preventable by what means.

Brief abstracts of fifty-two cases are submitted:

CASE I. Adult negress, vaccinated on the arm, July 31, 1839, near New Orleans. No dressing used. No statement as to possible means of infection. Symptoms, trismus, rigidity, convulsive twitchings; duration, over 2 weeks; treatment, large doses of opium; result, recovery.

CASE II. White child, aged 5 years, vaccinated by arm-to-arm method, October, 1845, at Lowell, Mass. No dressing used. Vaccinated by mother with a darning needle. Tetanus developed in a few hours. Symptoms, convulsions and prostration; duration, 24 hours; result, death.

CASE III. White child, aged 7 years, vaccinated by arm-to-arm method, May 15, 1879, at Lowell, Mass. No dressing used. Vaccinated by mother with a darning needle. Tetanus developed in a few hours. Symptoms, prolonged convulsions, then prostration; duration, 24 hours; result, recovery.

CASE IV. White boy, aged 3 1-2 years, vaccinated on the arm by a mid-wife, May 15, 1879, in the southern part of the United States. No dressing used. Infection through large ulcer formation after the crust was torn away. Tetanus developed in 3 weeks. Symptoms, trismus, risus sardonicus, convulsions; duration, 24 hours; result, death.

CASE V. White boy, aged 9 years, vaccinated with "bovine quill" virus on the arm, January 6, 1882, at Auburn, N. Y. No dressing used. Large ulcer excavation, lymphangitis, etc. Tetanus developed in 20 days. Symptoms, trismus, severe convulsions, opisthotonos; duration, 10 days; treatment, morphine; result, death.

CASE VI. White male, aged 40 years, vaccinated on the arm, January, 1882, in Maryland. No dressing used. Extensive ulcer and surrounding inflammation. Tetanus developed in about 3 weeks. Symptoms, trismus,

convulsions, risus sardonicus, opisthotonos and coma; duration, 7 days; treatment, chloral, potassium bromide in large doses; result, death.

CASE VII. Colored boy, aged 5 years, vaccinated on the arm with humanized virus, February 9, 1882, at Columbia, S. C. No dressing used. Small ulcer bathed in pus at the site of the vaccination. Tetanus developed in 25 days. Symptoms, trismus, marked spasm of the muscles; duration, 15 days; treatment, potassium bromide, fluid extract of physostigma, chloral; result, death.

CASE VIII. White boy, aged 2 years, vaccinated May 29, 1886, at Havana, Cuba. No dressing used. Deep ulceration of tissues. Tetanus developed in about 30 days. Duration, 4 days; treatment, chloral, laudanum enemata; result, death.

CASE IX. White girl, aged 2 months, vaccinated by arm-to-arm method, September 10, 1889, in England. Vaccination dressed with red rags, ointment, poultice, shield and bathed with oatmeal water. Large ulcer and extensive slough, unclean dressing, cases of tetanus in the neighborhood. Tetanus developed in 21 days. Duration, 3 days; result, death. Case of umbilical tetanus died shortly after in the neighborhood; poultry and rabbits kept in the yard next to door of house; bad surroundings.

CASE X. Negro boy, aged 9 months, vaccinated July 12, 1891, in Cuba. No dressing used. Crawling constantly on hands and knees in the dirt of yard. Tetanus developed in 19 days. Symptoms, trismus, convulsions; duration, 32 hours; result, death. Surroundings and coverings all uncleanly and unhygienic.

CASE XI. White girl, aged 5 1-2 years, vaccinated with bovine virus on the arm, November 6, 1893, on Long Island, N. Y. Dressing at first sterile, later rags and soiled vaseline. Deep ulcer formation, and uncleanness in care of wound; aphthous stomatitis present. Tetanus developed in 25 days. Symptoms, marked trismus, risus sardonicus, opisthotonos, convulsions; duration, 5 days; treatment, bromides, chloral, ice bags, chloroform; result, death.

CASE XII. White girl, aged 7 years, vaccinated in Philadelphia, on October 2, 1896, with "fluid vaccine." No dressing used at any time. Deep vaccine ulcer. Child played continually in stable adjoining home. Interval from vaccination to tetanus 7 days. Tetanus lasted over one month, with trismus, opisthotonos, etc. Chloral and bromides used and recovery followed.

CASE XIII. White boy, aged 8 years, vaccinated in Philadelphia, on October 3, 1896, with "fluid vaccine." No dressing at any time. Necrotic condition of the tonsils and uvula. Klebs-Löffler bacilli found. Large vaccine ulcer. Interval before tetanus 20 days. Antitoxin and calomel used and recovery followed.

CASE XIV. White male adult, soldier, vaccinated in United States Army, in 1890, and died in Havana, Cuba. No history obtainable except that patient was one of the Volunteer soldiers in the Spanish-American War. The troops had little or no care, and vaccination was done by the wholesale. Death resulted.

CASE XV. Colored soldier, vaccinated July 17, 1899, in the United States, with glycerinated virus. Sterile dressing used at beginning. Interval

before tetanus, 16 days. Death followed after less than 3 days of trismus, opisthotonos, convulsions, etc. Morphine and chloral were used.

CASE XVI. White girl, 10 years old, vaccinated in October, 1899, in Brewster, N. Y., with glycerinated lymph. Fish-lard was applied to the vaccine ulcer 18 days later, and on the 21st day tetanus appeared. Death followed.

CASE XVII. A native child was vaccinated in Porto Rico, in 1900, with a dried point. Asepsis was employed in the beginning, but later no care was used and no dressing. Tetanus developed in "several days" and death followed. Of about 1,000,000 vaccinations this one alone developed tetanus.

CASE XVIII. White girl, aged 8 years, was vaccinated in Paris, Tenn., on November 27, 1900, with a dried point. Vaccine wound dressed with old quilt wadding up to the time of the appearance of tetanus. Scab had been knocked off by schoolmate. Three weeks after vaccination tetanus developed and death followed.

CASE XIX. White boy, aged 8 years, vaccinated on January 3, 1900, in Kalamazoo, Mich., with glycerinated lymph. Shield used until the arm was dry. Then no dressing. Scab torn off at school. Arm and sleeve filthy at time tetanus developed, 24 days after vaccination. Death followed 5 days later. Morphine, chloroform, and antitoxin were used.

CASE XX. White adult female, aged 21 years, vaccinated on the leg, on March 8, 1901, in Glasgow, Scotland, with "calf's lymph." A bunion plaster and strips of adhesive plaster were used as the dressing, the latter not being removed for 2 weeks, when the ulcer was covered by a greenish slough. A bread poultice was then applied. Tetanus appeared 14 days after vaccination, with trismus, twitchings, etc., and finally ended in recovery. Large doses of chloral and potassium bromide were used.

CASE XXI. White girl, aged 12 years, was vaccinated with a dried point, in Burlington, Vt., on October 2, 1901. No dressing was used over a considerable portion of the time. The scab was removed leaving a large ulcer. Nineteen days after vaccination tetanus appeared and death followed. The child had assisted in taking up potted plants while the open ulcer was on her arm; the earth from several places around her home subsequently gave virulent cultures of the tetanus bacillus.

CASE XXII. White girl, aged 12 years, vaccinated with a dried point, in Burlington, Vt., in October, 1901. A celluloid perforated shield was used. The scab was later removed, and an extensive ulcer formed. Twenty-one days after vaccination tetanus developed and death ensued. This and the preceding case were the only ones resulting in tetanus out of several thousand persons vaccinated in the town.

CASE XXIII. White female child, aged 11 months, vaccinated in a suburb of Philadelphia with a glycerinated point, on October 9, 1901. A perforated shield was used and allowed to remain in place 28 days until tetanus developed. Death occurred in 36 hours in spite of active treatment with large and repeated doses of antitoxin, hypodermic injections of carbolic acid, bromides and chloral. The child lived over a stable, and slept in bed with its father who was a stableman. (Writer's case.)

CASE XXIV. White male child, 7 years old, vaccinated with glycerinated virus, on October 10, 1901, in Camden, N. J. A shield only was applied. The scab was lost during play, fell on the ground, and was replaced in the wound. Nineteen days after vaccination tetanus appeared, with trismus, convulsions and rigidity, and in 3 days death followed. The boy's brother was vaccinated from the same tube, the vaccination proving successful and normal.

CASE XXV. White girl, 16 years old, vaccinated with a dried point, on October 12, 1901, in Camden, N. J. A perforated shield was applied. A large amount of pus and filth was allowed to collect under the latter, and 25 days after vaccination tetanus set in with trismus and convulsions, and death followed in 7 days.

CASE XXVI. White girl, 6 years old, vaccinated with a glycerinated point, on October 14, 1901, in a suburb of Philadelphia. At first a shield was used, then a rag. The child lived over a stable, and she and a playmate had been throwing dirt at one another shortly before tetanus appeared, 22 days after vaccination. Trismus and opisthotonos were present and in 9 days death followed.

CASE XXVII. White girl, aged 11 years, vaccinated with glycerinated lymph, on October 19, 1901, in Camden, N. J. At first a shield was used, then no dressing, later a rag. Eighteen days after vaccination tetanus developed with trismus, opisthotonos and convulsions. Depressomotors were used, but death followed in 3 days.

CASE XXVIII. White boy, aged 11 years, vaccinated with "tube virus," in Bristol, Pa., on October 19, 1901. The arm was bandaged with cloth. Patient threw bandages on ground and replaced them on arm. Twenty-two days after vaccination tetanus appeared, and lasted 48 hours. Trismus, opisthotonos and convulsions ended in death. The actual cautery and intracerebral injections of antitoxin were used.

CASE XXIX. White girl, aged 7 years, vaccinated with a dry point, in Camden, N. J., about October 1, 1901. A shield only was applied at first; later ointment and boiled rags. The shield was left in place for over 2 weeks, and a flaxseed poultice used. Tetanus developed at least 7 weeks after vaccination and lasted 7 days; the trismus and opisthotonos terminated in convulsions and death.

CASE XXX. White girl, aged 8 years, vaccinated with glycerinated lymph, in Camden, N. J., on October 21, 1901. A *papier-mache* shield was applied. Child exhibited vaccine sore to playmates. Twenty-two days after vaccination tetanus appeared and ended in death after 2 1-2 days of trismus and convulsions. Morphine and antitoxin were used.

CASE XXXI. White boy, aged 16 years, vaccinated on October 22, 1901, in Camden, N. J., with glycerinated lymph. A bunion plaster was applied and held in place by adhesive strips, remaining in place until 9 days later, when tetanus developed. Trismus and convulsions lasted 6 days, when convalescence began. Antitoxin was used in addition to symptomatic treatment. The physician who vaccinated the boy states that the case was not one of tetanus but meningitis.

CASE XXXII. White boy, aged 11 years, vaccinated on October 23, 1901, in Camden, N. J., with glycerinated lymph. No dressing was employed. When tetanus developed, 20 days later, a gray merino undershirt sleeve was matted in the ulcer. Trismus and opisthotonos lasted about 36 hours when death resulted.

CASE XXXIII. White boy, aged 5 years, vaccinated with glycerinated lymph, in Camden, N. J., on October 25, 1901. Boy lived within 15 feet of a stable. Fourteen days after vaccination tetanus developed and death followed after about 36 hours of trismus and opisthotonos. The patient had caught his arm on the hook of an ice wagon, tearing the skin, etc. about a week before tetanus developed.

CASE XXXIV. White girl, aged 8 years, vaccinated in Camden, N. J., on October 26, 1901, with glycerinated lymph. Nineteen days after vaccination tetanus appeared, with trismus, opisthotonos and convulsions. The patient recovered.

CASE XXXV. Colored girl, aged 9 years, vaccinated in Camden, N. J., on October 26, 1901, with a glycerinated point. There was also an open sore on the lip at the time. Twenty-three days after vaccination tetanus appeared, with trismus, opisthotonos and convulsions. Chloral and bromides were used, but death resulted. Brother was vaccinated at the same time and with the same virus; no tetanus resulted.

CASE XXXVI. White girl, aged 4 years, vaccinated October 26, 1901, in Philadelphia, with glycerinated lymph. Patient's home separated only by a door from a stable. Eighteen days after vaccination tetanus developed with trismus and opisthotonos. Bromides and morphine were used and recovery was the final outcome after a protracted convalescence. Older sister vaccinated from the same tube and no tetanus resulted.

CASE XXXVII. White boy, aged 7 years, vaccinated in Atlantic City, N. J., in October, 1901, with glycerinated lymph. A shield was worn for 3 days, then a rag was tied around the arm. Twenty days after vaccination tetanus appeared, and in 4 days death took place with trismus, opisthotonos and convulsions. Bromides, chloral and antitoxin were used.

CASE XXXVIII. White boy, 12 years old, vaccinated November 3, 1901, in Bristol, Pa., with glycerinated lymph. Shield was allowed to remain in place until filled with pus, and 21 days after vaccination tetanus appeared. Death followed in 3 days with trismus, opisthotonos and in spite of active treatment with cannabis indica. Patient had frequently pounded his vaccinated arm to show that it did not hurt.

CASE XXXIX. White boy, 10 years old, vaccinated in Bristol, Pa., on November 4, 1901, with a glycerinated point. The shield was not removed for 18 days, a rag then being tied around the arm. On the 23d day tetanus developed and death followed in 5 days, with trismus and convulsions. Carbolic acid injections, chloral, bromides and morphine were employed. This patient was vaccinated by a policeman.

CASE XL. White girl, aged 13 years, vaccinated in Camden, N. J., about November 4, 1901. No dressing used at first; later a rag. Twenty days after vaccination tetanus appeared and death followed in 36 hours, with trismus, opisthotonos and convulsions. Bromides, chloral and antitoxin were used.

CASE XLI. White female, aged 24 years, vaccinated about December 9, 1901, in Philadelphia, with glycerinated virus. No dressing was applied and in 20 days after vaccination tetanus appeared, lasting nearly 3 weeks with trismus and convulsions and ending in recovery. Bromides, chloral, asafoetida and antitoxin were used.

CASE XLII. White child, vaccinated "since 1899" (exact date not obtainable), in Chicago. At first no dressing was used and later a bandage. Tetanus developed several weeks after vaccination, during most of which time the same bandage remained over the wound. Death resulted.

CASE XLIII. White child, vaccinated also in Chicago about the same time. Tetanus developed and the child died. Three other children were vaccinated in the same family with the same lymph and with normal results.

CASE XLIV. White female adult, vaccinated with a glycerinated point, in Cleveland, O., in 1901 (May 27-30). A shield only was applied. In 15 days after vaccination tetanus developed, with trismus, opisthotonos and convulsions. Depressomotors and repeated large doses of antitoxin were used, but death ensued in 7 days.

CASE XLV. White boy, aged 6 years, vaccinated in February, 1883, in New York City. Twenty days after vaccination tetanus appeared, and trismus, opisthotonos and convulsions lasted 5 days, when convalescence began. Large doses of whiskey were used. Eight months previous patient had had an attack of tetanus following a wound of the foot and recovered under the same treatment.

CASE XLVI. White boy, aged 10-12 years, vaccinated in Auburn, N. Y., in 1885, with bovine lymph. Two weeks after vaccination tetanus appeared and death followed in less than a week of trismus, opisthotonos and convulsions.

CASE XLVII. White male, aged 38 years, vaccinated with a dry point in Philadelphia, on November 18, 1901. No dressing was retained after the first few hours. Seven days after vaccination tetanus developed and death followed in 24 hours with trismus and convulsions. Carbolic acid, cocaine, atropine and morphine were used. Patient was an inmate of insane ward of almshouse.

CASE XLVIII. White male, aged 45 years, vaccinated on November 8, 1901, in Philadelphia, with a dry point. No dressing was used after the first few hours. Nineteen days after vaccination tetanus developed and in 3 days death followed with trismus, risus sardonicus and convulsions. Antitoxin (immunizing and curative doses) was used in quantity. Patient also an inmate of insane ward of almshouse.

CASE XLIX. White boy, aged 6 years, vaccinated in Massachusetts, on September 10, 1901. Sterile gauze and bandage applied at first; then dressed at home by mother. Dirty dressing retained for days. Twenty-one days after vaccination tetanus appeared, ran a severe course and finally recovered.

CASE L. White girl, aged 6 years, vaccinated with a glycerinated point in Philadelphia, on June 7, 1901. No dressing was used. Twenty-one days after vaccination tetanus began and trismus, convulsions, opisthotonos and death followed in 36 hours. Antitoxin, bromides and chloral were used.

Among 12,000 cases vaccinated by the same physician and the same virus no other instance of tetanus developed.

CASE LI. White male, aged 31 years, vaccinated in Philadelphia on November 11, 1901, with a dry point. No dressing was used after the first few hours. Twenty-three days after vaccination tetanus developed and after 15 days of trismus, convulsions and exhaustion, death took place. Carbolic acid, morphine, atropine and whiskey were used. Patient in insane ward of almshouse.

CASE LII. White male, aged 38 years, vaccinated with a dry point in Philadelphia, on October 27, 1901. No dressing used after the first few hours. Sixteen days after vaccination tetanus appeared, and in 5 days death ensued. Trismus and convulsions had been constantly present. Carbolic acid and anti-toxin were used. Patient also an inmate of the insane ward of the almshouse.

The above series does not include eighteen cases that had a "stiffness of the neck and jaws, with a bad arm, and whose symptoms disappeared under full doses of the serum"—that occurred in the Philadelphia Hospital and at the same time approximately as the genuine cases already cited. The symptoms in all of the eighteen were indefinite and may or may not have been cases of tetanus, but in all probability were not.

In studying the cases in this series, the manner of preparation of the virus has been considered, and especially the suddenness and proportions of the demand for the same. Also the care used in testing such virus before placing it upon the market, and the bacteriological and inoculation experiments that have been possible either before or after infection. Also the method of vaccination, the after care of the wound, the incubation period of the tetanus, the clinical symptoms, the grouping of the cases as to time and locality. And finally, any possible or probable source of infection, other than the vaccine wound and the vaccine virus. Such evidence as has been submitted in the recent cases is unusual both as to amount and quality, and is unobtainable in cases that date back even for a few years. In England no such tests have been made, and evidently no suspicion was entertained that the virus might have caused the infection. It is interesting in this connection to note that in no case recorded in the literature have tetanus bacilli or their spores been obtained from the vaccine wound, either on the cover glass preparation, or in the culture tube, though many attempts have been made.

With regard to the method of vaccination we are especially concerned. It is as well known that former methods were dangerous and liable to introduce infection as the fact that to-day most vaccinators realize the responsibility of their task, and take proportionate care in the preparation of the site, and throughout the entire process of vac-

cination. The larger the surface scarified, the greater the surface exposed to possible secondary infection. But apart from a seeming lack of thoughtfulness upon this point, we may say that to-day only rarely does a case suffer from the carelessness of the operator. There seems to be no question that Case XLI is an example of just such carelessness, not only in the operative procedure itself, but in the lack of care in the matter of instructing the patient as to the dressing of the wound. Such cases are as rare as they are criminal, and the absence of such a coincident influence in any of the other recent cases reported in this city or in Camden, or in fact throughout the country, is one that is a subject for congratulation. The fact that tetanus appeared after and during vaccinia in the days when vaccination methods were careless, and there was no subsequent care of the wound; and at a time when the healthy virus was carried directly from one arm to another, rather indicates that the same causes operate now as did then, and that if the infection occurs at all, it is during or after the operation. Remove the possibility of uncleanly surgical procedure, and there is but one alternative remaining.

The subsequent care of the wound presents a field for thought that comes much closer to the question of tetanus infection than any yet touched upon. In every instance, in the series of cases included in this paper, in which any information could be obtained whatsoever, there has been found (*vid. case-histories*) some gross breach in the care of the wound; and usually the presence of some active influence that would offer more than a likely means of entrance for the tetanus or any other infection. Probably no extensive series of vaccinations has been executed with such studied aseptic care, and with such similar methods as that in the case of the students of the University of Pennsylvania; and probably no more uniform results have ever been obtained from vaccination. The successfulness and effectiveness of these vaccinations were evidenced by the fact that out of the entire student body only one contracted smallpox, and he the son of a homeopathic physician who was at that time, and for weeks previous, in attendance upon a case of virulent, confluent smallpox. He had refused to allow his son to be vaccinated until required to do so by the University authorities, and the operation was done so late that it fell far within the ordinary incubation period of smallpox. By way of contrast, it is worthy of note that of the cases studied in this paper, many wore no dressing upon the arm until tetanus appeared. In fact, until a recent time no dressing was considered necessary; and to-day many men refuse to look upon the surface which they scarify as a surgical wound. Nearly every case showed for days a large open ulcer, burrowing deep into the tissue. Two

cases were those of soldiers, sleeping anywhere and everywhere, and looking on a bath as a luxury. Several lived over and next to and played continually in stables, the hot bed of the tetanus bacillus. One slept in bed every night with her father who had charge of the horses. Two, at least, are known to have forcibly maltreated the vaccine wound. Many removed the scab for inspection. Two threw or dropped the scab on the ground and replaced it in the wound, one wearing it for hours. One threw his bandage upon the ground and replaced it on the arm at a later time. Several wore a shield over the wound without cleansing or removing until it was full of pus and dirt and foul to the smell; one of these reached the eighteenth day, and the writer's case the twenty-eighth day with the shield still in place. One, when tetanus developed, exhibited a merino shirt sleeve that had never been washed, matted in the vaccine wound. Two Glasgow physicians, in recently reporting a case (*Lancet*, March 22, 1902), sarcastically comment upon the conclusions of the Camden Health Board, and yet they themselves in searching for a "subsequent infection of the vaccine wound" (which they declare impossible), forget that they placed over and around it a "bunion plaster" covered with adhesive strips, and that this was not removed for two weeks. One need not even accuse the skin of furnishing the tetanus infection under such circumstances. For fairness' sake, if they did their duty by the skin, as we are convinced they did, it should be considered as less likely than the "bunion plaster" to have been to blame. One child had been throwing dirt at another shortly before tetanus appeared. A very few cases had ulcerative lesions on the lips or mouth, or on other portions of the body. No one had even an approximately aseptic treatment throughout more than a small portion of the time from vaccination to tetanus. Only one was excluded from the chance of outside infection at any time in the course of the vaccinia, and this time was probably so short that it can hardly be considered. And with this point we conclude our investigation of the possibility of outside infection. Tetanus has occurred in surgical conditions and in operations in which the technique has seemed flawless, and no care is too great if the disease is to be prevented. The writer well remembers a series of deaths from puerperal tetanus that occurred in the hospital service of one of his professors during his graduating year and was caused by a bichloride vaginal douche that carried the tetanus spores. Bauer (*Ziemssen's Cyclopaedia*) cites many cases of tetanus in which there was no injury to the surface of the body. Tetanus has been known to follow the extraction of a tooth, the application of cupping glasses, the sting of a bee, the catching of a fishbone in the throat, the application of a blister, the hypodermic use of drugs, and during the last year there

has been reported a case in which the only abnormality in the body was the presence of ascarides in the intestine. In the *Medical Times and Gazette*, 1854, p. 376, etc., a long series of cases is cited of tetanus following burns. It seems hardly likely that any one will consider it probable that the scorching substance introduced the tetanus bacillus or its toxin. Such occurrences indicate that the micro-organisms are always at hand, and that, as with Shiga's and Flexner's bacillus of dysentery in uremia and chronic diseases, the opportunity is all that is needed to start the attack. The bacillus is always to be found in the dirt of the street as has been shown by repeated experiments. Moreover, its distribution varies in localities in such a way as to warrant the statement by Bauer, that "According to the report of Holland the disease is rare in Iceland, while upon the neighboring island of Heimaey, the population would die out if it were not recruited by immigration, since almost all the children die of tetanus." Long Island is an especially afflicted portion of our own country. In the garden soil and manure the tetanus bacillus is particularly at home, and there is no doubt that the skin every day, and perhaps always, is the habitat and resting place of not only some of that dirt, but the tetanus bacillus. Chantemesse and Widal have obtained pure cultures from the vagina. It does not seem necessary that the infection, even in most cases, must come from the skin as suggested by the Drs. Findlay; nor that the proximity of the vaccine wound to the ground had more than a passing influence. They themselves suggest shortly after, that the wound was completely sealed from the atmosphere, and in this way they deny their own proposition. In only three of the cases in our series was the vaccination known to be on the leg (Cases XX and XXIII), and one of these being a baby was hardly likely to sweep the dirt from the ground "with its skirts." In Cases XXIV and XXVIII the infection almost certainly did not come from the skin, but directly from the ground to the wound. Such opportunities for infection of the vaccine wound, as have been cited in the above series, would not be considered doubtful in the case of a typical surgical wound. Not even a shield can be looked upon as protection for an open wound. A surgeon would be drummed out of the profession who allowed such opportunities for infection to occur, and by his patients if not by his colleagues. Neither should we hesitate here in fixing upon the probable means of entrance of the tetanus bacillus. Closely allied in its weight of evidence is the period of incubation. Of fifty cases, in which the period of time between the vaccination and the appearance of tetanus was known, in forty-five, fourteen days or more elapsed; in thirty-one twenty days or over; in six twenty-five or over; in one twenty-eight days and in one seven weeks. In only five cases was

there any resemblance to the period of incubation ordinarily ascribed to acute tetanus. Two cases (II, III), appeared and terminated in a few hours. These cases were vaccinated by the arm to arm method, and by a darning needle. Graetzner (*Der Krampf. insbes. der Wundstarr. Krampf.*, 1828), has noted a patient whose leg was amputated, and who developed typical tetanus the moment the crural nerve was included in a ligature and died of tetanus in six hours. Robison (quoted by Bauer) records a case of a negro, who wounded his finger with a piece of porcelain and developed tetanus a half hour later. Ward, of Manchester, a case developing tetanus ten weeks after injury. Friedreich one three months after injury and Morgan one two months after the wound had healed. In the latter case the autopsy showed a splinter of wood in the cicatrix (all quoted by Bauer). It has already been shown in a previous article that the incubation period in tetanus may vary from a few minutes to many weeks. That of the large number of cases in the Civil War averaged eight days. But there is no variance in the opinions of writers on the subject that the usual incubation period of tetanus, and invariably that of the fulminant or acute type, is comparatively short, averaging about ten days and often amounting to a few hours. In the series now considered there has been an almost invariable occurrence about the twentieth day following the vaccination. It has been previously pointed out that this is the time when most often the vaccine wound is exposed through loss or injury of the scab; and also the time when the patient is most likely to be careless of the healing wound. Still more cogent is the fact that it is at just this time that tetanus would be expected if it occurred as a secondary infection of the vaccine wound at the acme of the vaccinia. It must not be forgotten that the tetanus organism may rarely be introduced in substances such as the splinter in the case cited above, and at length be liberated. This, however, cannot have been the order of things in the cases under discussion, since no foreign body is introduced in the operation of vaccination that would harbor the tetanus organism other than the glycerine, which is itself a powerful hypodermic irritant, and would tend to accelerate rather than to retard the action of the tetanus process by disabling the tissues. Two interesting cases have been reported of tetanus infection through a chronic ulcer of the leg, approaching the picture in vaccinia better than any other example offered. The one is noted by Greenwood (*Lancet*, April 30, 1898), and the other by Garnier (*Presse Médicale*, No. 75, 1898), neither ulcer having been cared for, and one being on the leg of a tramp who, presumably, often slept upon the ground. The second was a varicose ulcer. In neither of these cases

was any other lesion discoverable upon the body. Such cases are not needed, however, to witness self-evident facts.

The clinical symptoms in fifty-one out of the entire number of cases, when ascertainable, have been found to be of the most severe type. In all except Cases II and III there was well-marked trismus, and if we are correct in thinking that these cases actually were of tetanus, this symptom may have been present. The report is too meagre to be of much value. In nearly all of the cases there were repeated convulsions. In twenty-five opisthotonos. In all, when the symptom was mentioned at all, there was rigidity of the abdomen, and in many of the whole body. In eleven the course of the tetanus lasted only a few hours; in twenty-four for under five days; in only nine for over a week; and the latter cases ultimately recovered after a mild attack. The termination was a fatal one in forty-one cases, and recovery followed in eleven, giving a mortality of 78.8 per cent. as against 50-60 per cent. as an average mortality in tetanus under all forms of treatment. In the chronic type, such as must have been present if the vaccination caused the infection, the prognosis is always fairly good, a large number of, if not most, cases recovering. This feature has been commented upon at such length in a former article that it seems unnecessary to dwell further upon it. If then we add to the acuteness and severity of the course the general fatality of the series, there seems to be still less ground for doubting the presence of a secondary acute infection. The mortality of tetanus in the Civil War was 89.3 per cent. There remain for discussion only a few minor considerations such as the age, the sex, the time of year, the grouping of cases, the frequency of occurrence and the final outcome of the case. Forty-one cases occurred in childhood, and eleven in adult life. Of these, four were under five years, twenty-four between five and ten years, twelve between ten and twenty years and eight above twenty. The large majority of cases of ordinary traumatic tetanus occurs in boys or men, and for obvious reasons of exposure, etc. In this series there seems to be little difference between the two sexes in this regard (male, twenty-eight; female, twenty-two; sex not stated, two); and perhaps for the equally obvious reasons that at the age (childhood) when vaccination is most often performed, both sexes are equally exposed to moderate violence and to contamination from soiled clothing and uncleanness of person.

It is noteworthy that in the entire series of cases more than half (and all cases of the recent epidemic) occurred between October 1 and March 30. This is contrary to the old belief which gave the summer the greater number of cases. Solly and Simon (*Medical Times and Gazette*, June 17, 1854), have noted this same autumnal

and winter occurrence in a long series of cases. No rule can hold, however, when a requisite condition is the furnishing of a number of external wounds for the entrance of the infection. Fourth of July, in America, will cause more cases in the summer than smallpox in the winter, and we must look upon the occurrence of the tetanus simply as being synchronous with a cause that prepares the way. Bauer states, however, that "in one and the same place there are variations in the frequency of tetanus at different times;" that "statistics with regard to certain districts in Europe also show differences in the frequency with which tetanus occurs in these various places."

There has been no well-marked grouping of cases following vaccination previous to the Camden epidemic. Glycerinated points and tubes, dry points, arm-to-arm vaccination, all methods are represented in the above list of cases, and the first three were used in the Philadelphia-Camden outbreak. It has already been mentioned that many of the cases were vaccinated with the virus from one producer. It seems unnecessary to conclude that this was more than a coincidence due to the fact that one production of virus was almost generally in use throughout the eastern portion of the country, and that in this way a far larger number of cases of vaccination were present for infection by the tetanus or any other organism than was the case with any other virus. Wells, of Chicago, has shown (*Philadelphia Medical Journal*, June 16, 1900, and *New York Medical News*, June 1, 1901), that the firearms and the cartridges and the wadding of the same are not the origin of the Fourth of July tetanus infection except as they carry into the firearm wounds means of infection already on the person; and this by a most elaborate and convincing series of experiments. His conclusions are that in all cases the infection has probably been from the skin, and that the wound merely opened the surface to the organism. He also states that, in Cook County, Illinois, between June 25 and July 14, 1900, there were twenty-seven deaths from tetanus. During the same period, in 1899, there were seventeen deaths, all in boys (the series upon which his bacteriological experiments were carried out). Two hundred blank cartridges were examined, representing all the makes used, and in none were the bacilli, their spores or toxins found. Six samples of street dirt from different places in Chicago all gave cultures of virulent tetanus bacilli. Similar experiments were carried out by Taylor and reported in the *New York Medical Journal*, July 20, 1901. He arrived at the same conclusions. Certain parts of Long Island, Chicago and (judging from the records of the Health Board of our own city) Philadelphia as well, have annually a long list of tetanus cases. During the year 1901, there occurred in Philadelphia alone twenty-nine cases of tetanus from causes other than vaccina-

tion, and during the period, October 1, 1901-January 1, 1902 (the time including the tetanus epidemic), there were in all twelve cases independent of vaccination. In short, there were more cases of tetanus in Philadelphia, from other causes during the same period, than from nearly a million open wounds due to the operation of vaccination. During 1899 there were seventy-three deaths in New York City, and in 1901 there were thirty-two deaths in Baltimore, all independent of vaccination. Twelve of the latter number occurred at one time. Six occurred in August, six in September and eight in October (the identical months of the Camden outbreak). Twenty-five of the thirty-two cases occurred in children under twenty-one days old, and all were in charge of midwives, none developing in physicians' hands. Twelve cases occurred within a few blocks of one another and under the care of one midwife. Traumatic cases were reported in Camden, Pittsburg, Trenton and, in fact, all of the cities neighboring upon Philadelphia, at the same time with those associated with vaccination. No case of tetanus has ever followed vaccination in the District of Columbia, though there have been occasional cases due to trauma. On the other hand, Craig mentions (*Medical Examiner and Practitioner*, April, 1901), several cases following vaccinia in Brooklyn (1896-1901), though the records cannot be obtained. Seven cases have been reported in the newspapers as occurring in Cleveland, during 1901, with regard to which no information can be elicited. One case was noted in St. John, Nebraska, another in Cambridgeport, Massachusetts. The result of treatment in the cases analyzed in this paper only bears out the evidence already collected. In forty-one cases death was the outcome; although the incubation must have been one of three weeks to have connected the infection with the virus, an unheard of combination of an invariably long incubation with an acute course and a fatal result.

Our conclusions are as follows:

That infection has taken place in most, if not all, cases at the site of the vaccination. We have found that the exact time of infection, and the exact means, have up to this time been impossible of absolute and scientific proof; and that the grouping of a large number of cases in a certain locality, and following the use of a certain production of vaccine virus, would tend at first sight to speak for a primary infection, carried with or by means of the vaccine virus into the system.

On the other hand, we find that a secondary infection, and one occurring, as a rule, about the time of the acme of the vaccinia, is indicated by the otherwise discordant chronic incubation period and acute symptoms, by the almost uniformly fatal termination, by the severity of the course of the disease, by the millions of normal vac-

inations with the same virus, by the simultaneous deaths from tetanus known to be due to other causes, by the diminution in the number of such cases now that continued aseptic care is more generally exercised, by the fact that in every case in which particulars are known over-abundant opportunity was offered for such secondary infection, and finally and most important, by the absolute failure of all bacteriological and inoculation experiments on the lower animals and man, to indicate the presence of the tetanus micro-organisms or their toxins in the virus.

There is neither time nor space to admit of a discussion of the nature of the tetanus itself or its treatment, except to note the fact that out of thirteen cases treated with antitoxin, ten died and three recovered (mortality 76.9 per cent.). In all of these cases the usual treatment was employed in conjunction with the serum. Seven cases recovered under the customary routine of chloral, bromides, opium, cocaine and more rarely physostigma; and thirty-two died (mortality without antitoxin, 82 per cent.). Of the entire number of cases eleven recovered and forty-one died (mortality 78.8 per cent.). It would certainly seem as if the glycerinated virus, as well as the vicious influence of a shield, was disposed to present a more extensive ulcerative surface and a greater tendency to sloughing than the dried virus, or the arm-to-arm method. The latter is to-day an impossibility on account of the ever-spreading syphilization of the masses. But if it eventually proves true that, as time goes on, glycerinated virus opens a better avenue to the tetanus germ than the less cleanly but safer dried point, the risk may seem to be syphilis or tetanus, and we will have to beat a retreat until we discover a substitute for the glycerine that does not carry its disadvantages. Our whole series of cases seems to prove that the infection is one that depends somewhat upon the susceptibility of the person, otherwise it must needs be a much more frequent disease. Also that the tetanus micro-organism or its spores must frequently be present upon the skin, and ready to take advantage of an opportunity of entrance. How much more likely this must be the case when the patient is uncleanly or lives or plays in the street, garden or stable, needs hardly a word to direct the attention.

A paper such as this would have failed of its mission if it omitted in closing to repeat the statement that the vaccine wound is a surgical condition that requires as skillful care as an abdominal incision. And that the responsibility rests no more with the physician than with the patient to carry out strict asepsis in the care of the same until the perfect continuity of the surface is restored. Otherwise, let the one who relaxes suffer the blame if tetanus develops; and be it doctor or

patient that lets down the bars, his carelessness may cost a life and will almost as certainly as the disease develops. The symptoms of tetanus are the sealing of the death warrant, not the beginning of the infection. Fatality may rarely be averted, but the odds are too great to allow the risk. Tetanus in the course of or following vaccinia appears to be no more inevitable or necessary than hemorrhage after the tying of an artery. And if proper precautions be taken, only such cases as are predestined to bleed or to contract in a tetanic spasm will confront the physician. That vaccine virus may be infected with tetanus no one will deny. But that it has been, and in such cases as here come to view, deserves the full denial that has been given by the clinical symptoms and by a careful scientific study. It would appear that tetanus in the course of vaccinia is sometimes an unavoidable accident, due to the indiscretion or willfulness of children, old or young; but with the principle laid down that the wound shall be treated aseptically from start to finish, tetanus will disappear from the pages of the medical books as a complication of vaccination. And had the facts been realized sooner, the condition would never have found a place there.

The writer would acknowledge most cordially the assistance rendered by many physicians in the attempt to secure full clinical details of the cases included in this paper; and especially by Drs. Alfred Stengel, H. G. Wells, F. J. Runyon and C. Hampson Jones.

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Tetanus and Vaccination—An Analytical Study of Ninety-five Cases of this Rare Complication.

BY JOSEPH MCFARLAND, M. D.

[Read April 23.]

During the year 1901 the occurrence of smallpox in different parts of the United States stimulated the health authorities to a vigorous endeavor to protect the public by vaccination. Accordingly, during the year 1901, throughout many parts of the United States, an unusual activity in vaccination took place.

The occurrence of a number of cases of tetanus succeeding vaccination, first in Cleveland, Ohio, and then in Camden, New Jersey, early attracted my attention, as this, to me, unknown complication seemed a matter of the greatest importance, increasing the danger of vaccination and correspondingly arousing the animosity of those who have banded themselves together for organized opposition against this well recognized and only safeguard against smallpox.

The cases of tetanus in Camden have been so exploited in the

newspapers, and have been made the subject of so many editorials and comments in the medical press, that they will, no doubt, form the starting-point of numerous future attacks against vaccination. I therefore deem it important that as many cases of the complication as possible be brought together and carefully analyzed, in order to determine whether tetanus be a necessary or an avoidable complication of vaccination. If a necessary complication we should be prepared for it and know how often to expect it; if an avoidable one we should seek to eliminate it by every precaution regarding the selection of a superior virus and the performance of a careful operation.

Tetanus is not a recognized complication of vaccination. The only text-book I have been able to find making any mention of it is the recent edition of Osler's "Text-book of Medicine," in which it is simply stated that "tetanus occasionally follows vaccination." In the "Minority Report" of the British Commission, published in 1896, in which the disadvantages of vaccination are carefully and forcibly summarized, a single case is mentioned, apparently the only one they were able to collect. Ordinary writers upon vaccination entirely ignore tetanus. The literature on the subject is extremely meager. In the Index Catalogue of the Surgeon-General's Library at Washington, but *seven* cases are mentioned under titles by which they can be recognized, and I was able to find but fifteen cases in the literature.

Tetanus Cases Found in the Literature.

Dr. J. D. Cottman: New Orleans Medical and Surgical Journal, 1854-55, Vol. XI, p. 783.

Dr. G. Ross: South Clinic, Richmond, Va., 1878-79, Vol. I, p. 468.

Dr. W. C. T. Bates: Transactions, South Carolina Medical Association, Charleston, 1882, Vol. XXXII, p. 105.

Dr. T. Dimon: St. Louis Courier of Medicine, 1882, Vol. VII, p. 310-312.

Dr. H. J. Berkley: Maryland Medical Journal, Baltimore, 1882-83, Vol. IX, p. 241.

Dr. Rudesindo Garcia Rijo: Cron. med.-quir. de la Habana, 1886, Vol. XII, p. 388.

The Lancet, November 2, 1889, pp. 922-970.

Dr. Ruiz: Cron. med.-quir. de la Habana, 1891, Vol. XVII, p. 649.

Dr. S. W. S. Toms: Medical News, February 24, 1894.

Appendix IX to the Final Report of the Royal Commission on Vaccination, 1897, Case X, p. 6.

Surgeon-General's Report, June 30, 1900, p. 205.

Surgeon-General's Report, June 30, 1900, p. 205.

Surgeon-General's Report, June 30, 1900, p. 206.

Dr. J. W. Findlay: *Lancet*, February 22, 1902, Vol. I, No. 8, p. 506.

Dr. R. N. Willson: *St. Louis Medical and Surgical Journal*, April, 1902, Vol. LXXXII, No. 4.

These occurred at somewhat remote periods in different parts of the country, and were all attributed to secondary infection of the wound. It would seem reasonable, therefore, to conclude that tetanus has not been a frequent and important complication of vaccination in the past, either in this or any other country. It may, however, be surmised that what is true at the present time has also been true in the past, and that when tetanus occurred an attempt was made to suppress rather than publish it; if, however, any such occurrence of tetanus had taken place in the past as we have recently experienced, the medical literature would certainly contain some reference to it, as at present to the recent unpublished cases. For suppressed as they are at the present time, very few cases having been published in detail, rumors of cases and editorials referring to cases and speculating upon their occurrence are to be found in many of the journals. The lack of published information concerning the complication cannot depend upon failure to recognize it, as tetanus has been a well recognized disease for centuries, and indeed very little has been added to its symptomatology since the days of Hippocrates.

I have been able to collect a total of ninety-five cases. Throughout the paper I shall refer to *cases*, meaning by the term occurrences of tetanus that I have succeeded in authenticating, and of which I have considerable detail, while the term *rumor* will be used for cases of tetanus the occurrence of which seems certain, but concerning which, for various reasons, I have been unable to secure the details.

Cases from the literature, fifteen; cases collected: (a) with complete details, thirty-nine; (b) with incomplete details, thirteen; total, fifty-two; rumors, twenty-eight; total, ninety-five. Fatalities, sixty-one; recoveries, twenty-four; unknown, ten; total, ninety-five. Adults, twenty-five; children, forty-five; unknown, twenty-five; total, ninety-five. Males, thirty-eight; females, twenty-nine; unknown, twenty-eight; total, ninety-five.

The following summary shows the chronological order of the cases I have succeeded in collecting. The large number of cases that occurred in the year 1901 indicates that some exceptional condition existed that changed an unimportant and infrequent complication into a very important and frequent one.

Tetanus Cases, Showing Chronological Occurrence.

In 1839, one case; in 1878, one case; in 1882, three cases; in 1886, one case; in 1889, one case; in 1891, one case; in 1892, six rumors; in 1893, one case; in 1897, one case; in 1898, three cases, two rumors; in 1899, three cases; in 1900, one case; in 1901, forty-five cases, eighteen rumors; in 1902, five cases, one rumor; unknown date, one rumor. In 1901 there was a total of sixty-three authentic or rumored cases. Of these one occurred in March, one in June, one in July one in August, one in September, one in October, twenty-four in November and seven in December.

The occurrence of tetanus as a complication of vaccination has been variously explained as follows:

1. *That it is an accidental secondary infection of the vaccination sore.* Those holding this view think it depends upon conditions ever present and only to be expected, and that its occurrence is deplorable and preventable by the exercise of greater skill and caution in the performance of the operation and the subsequent treatment of the wound. That such a micro-organism as the tetanus bacillus, whose natural habitat is the soil and which occurs widely disseminated in nature, might occasionally be able accidentally to find its way into vaccination lesions cannot be gainsaid. It is certainly possible, and may occasionally happen, but there are very cogent reasons opposed to this view, and to content one's self with such a simple explanation may be to fall into egregious error, for if tetanus can thus occur, it should do so in all parts of the world, with more or less regularity.

The various indices to the medical literature are without any references to cases of tetanus following vaccination in the continental countries. A communication from the Imperial Health Office of Berlin informs me that the complication is *unknown in the German Empire*. Letters from the Pasteur Institute at Paris, the Pasteur Institute at Lille and the French Institute, inform me that the complication is *unknown in France*. No cases appear to have occurred in Italy, Russia or Austria, so that we are engaged in the consideration of a complication that is chiefly American and has become important within a year.

2. *That the occurrence of the complication depends upon a local prevalence of the tetanus germs.* The epidemic in Camden has been attributed to germs in the dust of that city, supposed to depend upon a prolonged period of dry weather. This entirely fails to explain the matter, for were this the true solution we should find ordinary traumatic tetanus occurring more frequently than usual. This is, however, not the case, as aside from the vaccination cases there were fewer than the usual number of cases both in Camden and Philadel-

phia. Further, while it is true that a greater number of cases occurred in Camden than in other places of equal size, the occurrence of tetanus following vaccination has too wide a geographical distribution to be explained in this way.

Cases are reported from seventeen different States in the United States, from the Dominion of Canada, Porto Rico, the Philippine Islands, Cuba, etc.

3. *That geographical conditions may exert a pronounced influence upon the occurrence of the tetanus, tetanus being particularly prevalent in certain districts.* Thus, it is said that Cuba and Porto Rico have soils rich in tetanus bacilli, and that Long Island has a particularly dangerous soil. That such an influence is important is, however, very doubtful, as from these territories we have very few cases reported (three Cuba, three Porto Rico, two Long Island).

Tetanus Cases, Showing the Geographical Distribution.

Canada: Three Rivers, Quebec, one case; St. John, N. B., one case. Connecticut: South Glastonbury, one case. Cuba: Havana, three cases. England: Lancet, one case; Commissioners' Report, one case. Illinois: Chicago, one rumor. Louisiana: New Orleans, one case. Maine: Biddeford, one case. Maryland: Baltimore, one case. Massachusetts: Belmont, one case; Cambridgeport, one case; East Denis, one case; Boston, one case. Michigan: Kalamazoo, one case. Minnesota: Minneapolis, one case; Taylors Falls, one case. Missouri: St. Louis, one rumor. New Jersey: Atlantic City, four cases, two rumors; Bridgeton, one case; Camden, eleven cases; Jordantown, one rumor; Millville, one case. New York: Albany, one case; Long Island, two cases; Owego, one case. Ocean: "City of Para," one case. Ohio: Cincinnati, one rumor; Cleveland, four cases. Pennsylvania: Bristol, two cases; Easton, one case; Girardville, one case; Lyndell, one case; Millbach, one rumor; Philadelphia, eleven cases, twelve rumors; Rosemont, one rumor. Philippine Islands, one case. Porto Rico, one case, two rumors. Scotland, one case. South Carolina: Charleston, one case. Tennessee: Paris, one case. Unknown, six rumors. Virginia: Richmond, one case. Wisconsin: Milwaukee, one case.

4. *That carelessness in the treatment of the vaccination wound is the source of the difficulty, because it facilitates accidental, secondary infection.* While this has a ring of genuineness about it, the argument is extremely unconvincing, if one takes into consideration the fact that for one hundred years vaccinations have been performed with a total disregard to cleanliness and asepsis in all parts of the world, on all classes of people, in towns and cities, by careless and careful physicians, upon clean and dirty persons, that it has been unusual

for any dressing to be applied in the past, and that during these many years tetanus has remained an almost unknown complication. We cannot conceive of any difference between the social conditions at the present and those of the past that are not immensely in favor of the present.

In our own country greater care is undoubtedly exercised at the present time than heretofore, and in those countries in which, because of ignorance and poverty, the same conditions prevail at the present time that existed a hundred years ago, as for example among the peasantry of Europe, we find tetanus practically unknown.

It is but now becoming recognized that vaccination is an operation, and that to free it from the common dangers of all operative manipulations, cleanliness and care are essential. We therefore find the skin cleansed and disinfected, and the lesion protected and dressed with a care never dreamed of a few years ago, yet when we come to examine the details of those cases which have come within our knowledge, we find that this care of the wound appears to be without influence upon the development of tetanus, for while many cases have occurred among ignorant and filthy children, in an equally great number of cases not only ordinary but extraordinary care seems to have been exercised. Thus one case occurred in the person of an adult sister of a physician in Cleveland, Ohio. Both the patient and the operator were refined and cultured people, were apprehensive of the results and exerted unusual precautions, yet despite all, death from tetanus followed this vaccination.

The densely ignorant and filthy people of the island of Porto Rico, with no knowledge of hygiene or personal care of themselves, living in a place reputed to be extremely dangerous because of tetanus, were vaccinated by the United States authorities after the occupation of that territory, and out of some eight hundred and sixty thousand vaccinations three cases of tetanus, two of which are very doubtful, occurred.

5. *The use of a shield to protect the vaccination wound has recently become quite common and has been blamed for the occurrence of tetanus.* It has, however, met with violent and perhaps justifiable condemnation on the ground that the pressure of the edges and of the adhesive plaster bandages by which it is held in place obstructs the lymphatic circulation and increases the severity of the wound and the danger of infection; also that the shield induces anaerobic conditions, so that by some the occurrence of tetanus has been blamed upon the shield. Upon looking over the cases reported, however, we find so few in which shields were used that they seem to have had no influence upon the occurrence of tetanus.

The Relation of Tetanus to the Vaccine Virus.

With the evolution of vaccination as a prophylactic measure, certain changes in technique have been gradually introduced. Thus bovine virus has now displaced the arm-to-arm and human scab vaccination previously employed, and within the last quarter-century the use of the human virus has been almost entirely given up. Only a few of the early cases drawn from the literature followed the use of human virus. Can it be that the danger of tetanus has something to do with the employment of bovine virus? This seems possible when we consider that it is only in the last half-century that cases have occurred; yet this can scarcely be, inasmuch as bovine virus is the only form employed in Belgium, Germany, France, and other European countries, where we find no tetanus. While it is suggestive that the first tetanus cases reported in the literature made their appearance about the time bovine virus came into general use, it is not true that the number of cases increased in proportion to the popularity of the bovine virus; for from 1854, when the first case made its appearance in the literature, until 1901, only isolated cases are reported, usually at intervals of years, a sudden extraordinary increase being observed in 1901.

The next step in the evolution of vaccination was the improvement in the quality of the virus, suggested by Copeman in 1891, by which glycerine was permitted to act for some time upon the virus, for the purpose of destroying micro-organisms which it contained. By the use of the glycerine a bacteria-free virus can be secured. This improved virus made slow but steady progress, until at the present time it has attained to the greatest popularity and bids fair to replace all other forms. It is used almost exclusively on the continent of Europe, and has made very large inroads into this country.

The glycerinized virus is so new, having been in use but ten years and in common use little more than five years, that we are scarcely able to express a positive opinion regarding its advantages and disadvantages. The advantage of having the contaminating bacteria destroyed by the glycerine is indisputable; the disadvantage of occasionally having the glycerine act so long that the specific germs of vaccinia are killed and the virus made inert is also indisputable. That at times, when the demands upon the manufacturer are exceptionally great, the virus mixed with the glycerine might be placed upon the market before the necessary time for the contained bacteria to be killed had elapsed is a somewhat grave danger. These possibilities somewhat lessen the confidence with which the preparation is received and used by many practitioners.

When we come to investigate the cases of tetanus concerning

which information is at hand, we are somewhat startled to find that a large number of them have succeeded the employment of this supposedly best and most refined preparation. This point will be discussed below.

Relation of Tetanus to Make of Virus in Cases in Which This Fact Could be Accurately Determined.

	Dry.	Glycerinized.		Total cases.
		Points.	Tubes.	
E	3	10	17	= 30
A	2	..	..	= 2
D .....	..	..	2	= 2
{ W .....	..	1	..	= 1
S .....	..	..	3	= 3
I	1	..	..	= 1
G	1	..	..	= 1
	7	11	22	40

Relationship to Particular Brands of Virus.

When an attempt is made to determine whether any particular brand or make of virus yields an unusually large number of tetanus cases, we find that while an occasional case of tetanus has succeeded the use of the virus of nearly all of the large manufactures, the great majority of the cases have succeeded the use of a particular brand of virus.

The brands of virus to be considered are called E., D., A., S., W., I., St. and Wd. Those called E., A. and D. are the products of the largest manufacturers, and it is not improbable that they do about an equal amount of business, so that the figures in the above table can be regarded as showing about the true proportion of cases to output. The other brands, W., S., I. and G., scarcely figure, G. being no longer made, I. not made in the United States and S. having a much smaller capacity than E., A. and D. It is probably safe to say that these vaccines are all made under careful conditions, with the exercise of as great an amount of skill as can be exerted with our present knowledge. No care or expense is spared to have the products perfect. We find, however, a remarkable discrepancy in the results following their employment; a discrepancy that leads me to conclude that tetanus bacilli may be contained in the virus and distributed with it.

The occurrence of thirty cases of tetanus after the employment of virus E. suggests that in it tetanus germs were present in larger

proportions than in any other, though the occurrence of only thirty cases following the use of millions of doses indicates that their number was small.

The Occurrence of the Cases in Groups.

In this connection must be pointed out as interesting and significant the groups of cases that have occurred from time to time. Thus in Cleveland, Ohio, during 1901, we note the occurrence of four cases; in Camden, New Jersey, during October, November and December, 1901, the occurrence of eleven cases; at Atlantic City about the same time, five cases; and in Philadelphia and vicinity, nearly at the same time, about twenty-five cases. A glance will show that the great majority of the cases studied occurred at about the same time. If we analyze these cases we find one vaccine (virus E.) chiefly if not exclusively implicated. The most instructive group of cases that I have been able to study occurred in the Men's Insane Department of the Philadelphia Hospital. In this institution with nearly four thousand five hundred inmates, there was a threatened epidemic of smallpox depending upon the admission of a case of smallpox from the street. After one or two cases had developed within the institution, it was decided to vaccinate every inmate, and the resident physicians went systematically through the institution vaccinating sick and well alike. The institution was thus vaccinated with the exception of the Men's Insane Department, the greater number of whose inmates were obliged to wait a few days until a new consignment of virus arrived. With this new consignment (virus E.) they were then all vaccinated. Upon looking up the statistics of the hospital, we find that in the insane departments, male and female, no case of spontaneous traumatic tetanus had developed within twelve years. It is, in fact, not known that there has ever been a case of traumatic tetanus developed within the walls of the institution, but this cannot be determined, as the records prior to twelve years ago were destroyed by fire. Succeeding the vaccination, however, a group of tetanus cases, confined exclusively to the Men's Insane Department, occurred. Here five typical cases with trismus and opisthotonos and every marked symptom of the disease occurred, all being followed by death, four from the tetanus itself, and one from pneumonia, occurring immediately after cessation of the spasms. The occurrence of this outbreak occasioned much alarm, so that every suspicious vaccination wound observed was thoroughly excised and treated antiseptically. After this excision of the wounds *eleven additional cases* developed trismus and muscular rigidity, though after the administration of enormous doses of antitoxin they all recovered. In my statistics these eleven cases

were considered as "rumors," as I did not consider the diagnosis above suspicion. In going carefully over the details of these cases, I find that with one doubtful exception every patient that developed tetanus was vaccinated with the same virus which had caused tetanus at Cleveland, Camden, Atlantic City, Philadelphia and elsewhere (virus E.).

Should it be suggested that the occurrence of groups of cases depends upon the popularity of the virus in certain districts, as Philadelphia, Camden, Atlantic City, where it was almost exclusively used, and that in these districts some telluric, atmospheric or other condition prevailed, causing them to be more predisposed to tetanus than the country in general, the idea should be at once dispelled by a few moments' consideration of the statistics presented. Thus if we deduct from the total thirty cases attributable to virus E. the six positive cases occurring in Camden, the seven positive cases occurring in Philadelphia, and the three positive cases occurring in Cleveland, there remain against this virus a total of fourteen cases, which is greater than the sum total of the cases referable to all the other viruses produced in the country, thus showing that even where the cases are scattered and not in groups, virus E. has four times as many cases as any other single virus, and many more than all the other viruses put together.

Forty cases are presented with exact information concerning the make and form of virus employed. Of these forty cases, *thirty* follow the employment of virus E., *ten* follow the use of all other forms combined, and no other single virus has a higher number than *three*. This seems to show quite convincingly that there is something about virus E. that is different from the others. We have in addition to these forty cases with complete details, eight cases in which it is known positively that one or the other of two viruses was used, but in which it cannot now be certainly determined which of the two it was.

We find that in the cases of this group vaccine E. figures in seven. If we assume, which it would be fairly justifiable to do, that all of these cases belong to E., then the disproportion is changed from E. thirty, to all others ten (30:10); to E. thirty-seven to all others eleven (37:11); thus making matters much worse. If, however, we proceed on the reverse order and admit that E. may be erroneously charged with these cases, we find the proportion E. thirty, to all others eighteen (30:18), so that matters are but little improved for virus E.

Dry and Glycerinized Viruses.

The respective influences of dry and glycerinized virus upon the causation of tetanus is shown by reference to the table, where we see

that seven cases followed the use of dry points, eleven the use of glycerinized points, and twenty-two the glycerinized tube virus. This proportion, seven to thirty-three, appears to be convincingly in favor of the dry virus, but we find the error caused by virus E. All three forms of virus E. have been followed by tetanus in the respective proportions of dry points, three; to glycerinized points, ten; and glycerinized tube virus seventeen. If we entirely omit virus E. from the consideration, we find the totals of all other viruses to be:

Dry points	4	} = 2 : 3
Glycerinized points	1	
Glycerinized tubes	5	

The proportion of four dry to six glycerinized being about correct when we remember that the glycerinized is the popular virus at the present time.

This seems to show pretty well that there is little general disproportion in favor of dry over glycerinized virus as regards the occurrence of tetanus.

The Source of the Tetanus Bacilli in Virus.

When we consider the distribution of the tetanus bacillus in nature, we find it in the soil, chiefly where it has been well fertilized. The tetanus bacilli are, no doubt, frequently swallowed by herbivorous animals in browsing upon the surface of the ground, and the anaerobic conditions for its growth being excellent, we find that the intestines of herbivorous animals commonly contain large numbers of them, and that with the intestinal evacuations they are deposited again upon the soil in increased numbers. The first source of danger, therefore, by which vaccine virus can be contaminated is the manure of the calf, the next source the dusts arising from the dry manure and the soil, both of which may be brought into the stables with the hay or upon the animals.

When large hay-fed animals are employed for the manufacture of virus, the manure is certainly a source of danger, but in stables where sucking calves are used for the purpose, fewer tetanus bacilli are present in the excrement. However, Huddleston found them present in the feces of 8 per cent. of the small calves used in the laboratory of the Health Department of New York.

It is evident that from these sources opportunities for the entrance of tetanus germs into the vaccine virus occur.

The Incubation Period.

The period of incubation of ordinary traumatic tetanus varies from a few hours to several weeks.

Tetanus Cases, Showing Incubation Period.

Shortest period, six days; longest period, thirty-nine days; average, twenty-two days. For points—shortest period, thirty days; longest period, sixteen days; average, twenty-three days. For glycerinized virus—shortest period, six days; longest period, thirty-nine days; average, twenty-two days.

The usual incubation period varies from seven to nine days. In the vaccination cases—that is, in cases of tetanus following vaccination—we find the shortest period of incubation to be six days, the longest thirty-nine, the average twenty-two days. It is thus seen that tetanus following vaccination appears on the average about two weeks later than ordinary traumatic tetanus. This is the sole weakness in the argument, and I think if this error could be eliminated it would at once be conceded that the remaining facts are indisputable. The late appearance of the symptoms is usually interpreted that the infecting organism entered the vaccination wound at a time when it was open, exposed and subject to secondary infection from the air, water, clothing, etc., with which it comes in contact. In truth, however, how rarely do superficial ulcerations become infected with tetanus! Did any one ever hear of a sudden paroxysmal outbreak of sixty-three cases of tetanus in one year following the infection of leg ulcers, furuncles, mosquito bites and other *superficial* lesions, even when cleanliness was not observed?

I think after the statistical demonstration that this secondary infection theory must be looked upon as a misinterpretation when applied to the cases of 1901, although it may occasionally occur and explain the rare cases of previous years. The fact probably is that the tetanus bacillus is ingrafted into the skin at the time of vaccination, but fails to find suitable conditions for its growth until after the development of the vaccine lesion paves the way by the local destruction of tissue. This makes us add to the usual incubation an additional period (a couple of weeks) during which the wound has been prepared for the implanted organisms, thus bringing the entire period to the length usually observed in the vaccination cases. Examination shows that no difference exists between dry vaccine on points and glycerinized virus regarding the length of the incubation period.

In nearly every case in which I have succeeded in securing details, I learned that the vaccination "took well." This may not be without

significance, though it may be interpreted in several ways. It may mean that those vaccinations in which marked local lesions occur are those in which secondary infection has the best chance of occurrence. If so, it means that severe vaccination lesions are dangerous, and that mild viruses should be used, the multiple insertion of a mild virus being preferable to a single insertion of an active virus. It may also mean that the lesion was caused by an impure virus, in which tetanus might be contained as well as other organisms. Lastly, and I think truly, it may mean that it is only when destructive local lesions occur that the implanted tetanus bacilli can find conditions suitable for their development.

Reference is again to be made to the chronological development of the cases, by which it will be observed that the majority of cases occur at a time when, because of agitation concerning smallpox, the demands for virus are great. This being the case it is not impossible that vaccine viruses are sometimes marketed a little anterior to the time when the action of the glycerine has extinguished the life of the bacteria in the virus.

Conclusions.

From the foregoing the following conclusions seem justifiable:

1. Tetanus is not a frequent complication of vaccination, a total of ninety-five cases having been collected.
2. The number of cases observed in 1901 was out of all proportion to what has been observed heretofore.
3. The cases are chiefly American and occur scattered throughout the eastern United States and Canada.
4. They have nothing to do with atmospheric, telluric or seasonal conditions.
5. They occur in small numbers after the use of various viruses.
6. An overwhelming proportion occurs after the use of a particular virus.
7. The tetanus organism may be present in the virus in small numbers, being derived from manure and hay.
8. Occasionally, through carelessness or accident, the number of bacilli becomes greater than usual.
9. The future avoidance of the complication is to be sought for in greater care in the preparation of the vaccine virus.

A complete list of the cases, with the particulars from which the above conclusions are drawn, is in my possession, though the fact that much of its most important information was given me in confidence prohibits its publication. To any one interested in any one of the cases I will be glad to furnish all that I know.

A New Inhaler Especially Intended for Use in Operations on the Eye or Face.

BY CHARLES W. LE FEVER.

[Read May 11.]

The difficulties experienced in the administration of general anesthesia during operations on the eye or about the face, must have been observed by all who have had experience in this branch of surgery, either as an anesthetizer or surgeon. When the ordinary inhalers are employed they are constantly in the way, both of illumination and the surgeon's manipulations, and when gauze or cotton pads or sponges are substituted, the frequent renewals of the anesthetic fluid which are necessary to keep the patient quiet, are equally annoying. This is especially true when ether is used. It was to overcome this difficulty that the inhaler herewith presented was constructed, and it is the result of many alterations from the original plan.

One of the principal difficulties met with in the construction of an inhaler which would serve the purposes in view, has been to secure the proper admixture of air and to have such air uncontaminated by the patient's breath, and the oxygen partially exhausted by having been previously breathed. The experimentation necessary to overcome this difficulty has impressed two facts upon the writer's mind, namely, that the greatest amount of oxygen compatible with complete anesthesia is best for the patient, and that the proper mixture of oxygen is secured from a much less volume of air, if each breath comes from a source not previously partially exhausted and at the same time charged with carbonic acid gas by previous breathing. The latter would seem to be a self-evident fact, and yet most inhalers, in their construction, disregard it. The construction of this inhaler is such as to secure the greatest amount of oxygen from the air breathed by admitting it from an entirely fresh source, and the amount of anesthetic used will be at the discretion of the anesthetizer, or as the case may require. This fact renders the inhaler equally useful for chloroform, but it must be remembered that the patient gets the benefit of as much of the anesthetic as is dropped in the receiver, none being blown out and the evaporating surface being but little. A much less quantity of the fluid is therefore necessary, and this fact establishes the point of its economy.

The question of interference with the operative procedures has been met by having the face mask just large enough to include the mouth and anterior nares without touching at any place except the rim. The receiver is placed at such a distance and at such an angle

that it rests over, and near to, the upper part of the chest, when the patient is prone. The connecting tube between the face mask and the receiver is attached to the former just over the point of the chin, and extends obliquely. Since there is no loss of the anesthetic, renewals are not called for at short intervals, and when they are, the surgeon's hands and arms are not apt to be in the way, so that he is given the freedom of the entire face for his manipulations. The face mask fits accurately to the face, leaving the regulation of the amounts of air and anesthetic, respectively, to the control of an afferent and an efferent valve, the latter allowing no air to enter except through the receiver, and the former allowing no exhaled air to enter the receiver.

The gauze should be placed in the receiver, just closely enough to prevent the anesthetic from running through it and accumulating in the bowl of the receiver, and at the same time not closely enough to prevent the free entrance of the breath. This requires about four yards of two-inch bandage, unwrapped and gathered loosely into a bunch. Should the fluid be poured in too rapidly, the connecting tube has been so placed that none will run through on the patient's face. If any should accumulate in the cup of the receiver it will at once be detected by the coldness to the hand which is supporting the inhaler. The face mask is made adjustable to different shaped faces by having a soft copper wire of considerable thickness turned under the edge of its rim, allowing it to be widened or narrowed at will. The practicability of this feature can be readily demonstrated by placing a stop of cotton or other material under the afferent valve, placing to the face and making suction, when the inhaler will adhere to the face by this support alone.

Its employment is simple enough. After adjusting the face mask to the face, and placing the gauze in the receiver as above directed, the inhaler is so held that the rim is at all places in contact with the face, taking care that it is not drawn too far up so that it will not fit the nose, nor so far down as to protrude over the chin. The anesthetic is at first dropped in very slowly, and later at the discretion of the anesthetizer. The movement of the valves or their audible clicking with each inspiration and expiration keeps the one in charge aware of the condition of the patient's breathing. This increases the safety of the patient as does also the ability to watch the features.

DISCUSSION.

DR. JAMES THORINGTON said that he had seen Dr. Le Fever operate on 2 occasions, on both of which the patient was anesthetized with this inhaler. In one case the physician handling the inhaler had never before seen it, yet he

had no difficulty in using it. He had noticed also the great freedom for the operator gained by its use. In the first operation there had been an enucleation of the eye; and in the second, a plastic operation on the lower lid. The feature which had seemed to him most fortunate was the clicking of the instrument by the ceasing of which, in a major operation on another part of the body, the surgeon would know that his patient had stopped breathing.

DR. GEORGE C. HARLAN said that he had seen a patient etherized by the use of the inhaler at the Wills Hospital. The instrument was entirely out of the operator's way. The patient had gone under the effect of the anesthetic easily, and although he had remained under the ether for nearly an hour, was in excellent condition. The instrument seemed to him a very great improvement on any other that he had seen.

Cyclic Vomiting in Children, with Report of Cases.

BY THOMAS C. ELY, M. D.

[Read May 14.]

All neuroses necessitate an exclusion of organic disease, a most difficult task, and an appreciation of an unusual excitability of the nervous system. Of all the various gastric neuroses, secretory, sensory and motor, with their protean manifestations, none are subjects of greater interest than the motor and, though perhaps of less frequent occurrence, none of the motor of more interest than cyclic vomiting.

The mechanism of vomiting includes a vomiting center, situated in the medulla near the respiratory center; from which impulses are sent to the diaphragm by the phrenic nerves, to the stomach and esophagus by the pneumogastric and to the abdominal muscles by the intercostal nerves. The complex act consists in an inspiration, the glottis closing, the diaphragm contracting, the longitudinal fibers of the stomach opening its cardiac orifice, when contraction of the abdominal muscles completes the act, forcing out the stomach contents. The muscles of the diaphragm, of the abdominal walls, of the stomach itself require simultaneous contraction and must be co-ordinated by a relatively strong nerve center. The process is almost physiological. Act of the will quite controls eructation, or belching of gas from the stomach and, in some instances, regurgitation or bringing up liquid or solid food from the stomach. Individuals have been able to vomit at will.

In the condition known as merycism or rumination, swallowed food is returned and chewed over again. Poorly masticated food may be returned and even enjoyed at will, says one writer.

With these strange exceptions, however, unlike a physiological process, the nervous and vascular systems are always reduced in power, probably not only by the act, but by the morbid process which produces the condition, acting on other parts of the nervous system than the vomiting center.

The differentiation of the causes of vomiting in children frequently presents difficulties. The causes are varied, children give little or no history, and the practitioner must grope his way much as the veterinarian. Called for the first time, or in the first attack, to a child with excessive vomiting, with little or no history, we wish to call attention to a class of cases to which such vomiting may belong, and the differentiation of such cases from other attacks of vomiting in children.

The attacks which are herein described occur in gouty and neurotic children and are due to toxins from faulty metabolism and faulty kidney elimination. The attacks are distinct neuroses, being due to the action of a toxin on the vomiting center in a predisposed subject.

Such neuroses have been described at length in literature by Holt, Rotch, Pepper, Griffith, Gee and other writers. The distinctive feature of this gastric neurosis, cyclic vomiting, is that it occurs in a certain type of children, gouty and neurotic. Cyclic vomiting has been likened to migraine in its tendency to recurrence or periodicity. Prostration is extreme. Death has been reported in two instances. One other case of death unreported has been brought to my notice by Dr. C. J. Seltzer, in which all known remedies were of no avail.

The vomiting is excessive, severe, protracted, and nothing can be retained by the stomach. Thirst is likewise excessive and distressing. There is no connection in an attack with diet or indigestion. There is generally a fever of indefinite type. Abdominal symptoms are quite immaterial and varied. The abdomen is generally about normal in appearance. There may or may not be constipation. The urine presents the most distinctive feature, being loaded with amorphous urates and uric acid crystals entirely out of proportion to the fever and other phenomena. Closer study of the urine in all cases may reveal the true cause, possibly blood examinations assisting.

The following case-histories illustrate the condition:

A boy of 6, well nourished, whose father is subject of arteriosclerosis, and whose mother suffers with recurrent attacks of migraine. The patient had been subject to attacks generally of no longer intervals than 8 months. The prodromes of the attacks were generally malaria, headache, and disgust for food and soreness of the abdomen, with some rise of temperature. The attacks of vomiting were sudden, several occurring every one-half or 2 or 3 hours, and lasting for several days, till the child was completely exhausted.

The fever continued throughout the attack. Convalescence was rapid. The urine was always loaded with excessive amorphous urates and uric acid crystals. The treatment consisted of calomel 1-10 grain, dry on tongue, every hour till 10 doses; cocaine, gr. 1-2 in 24 hours, given at 1-4 hour intervals; later, sodium phosphate. Restored health.

Girl of 7. Pale, round shouldered and of sickly appearance. Both parents were near the age of fifty at her birth and both are of marked neuropathic type. Her diet is always carefully regulated. Cold has precipitated an attack. There has never been a history of indigestion or constipation, no acid eructations, foul breath, coated tongue or bad taste in the mouth, preceding an attack. Skin, conjunctiva and stools are about normal and there is generally no gaseous distension of the bowels. The prodromes were heavy eyes, with dark rings beneath, no disposition to play, but rather to rest, lying down most of the day. Vomiting began suddenly. The child insisted on having the basin constantly at hand, saying every few minutes, "I am going to vomit," and retching violently. The blood was not examined. The urine was loaded with uric acid crystals and amorphous urates. Cocaine was given in large doses, gradually decreasing, and controlled the attacks with calomel in 1-10 grain doses, as before, dry on the tongue; and followed by sodium phosphate, and later by compound syrup of the hypophosphites. Convalescence was established.

Girl, aged 9 years. Of gouty family, attack precipitated by grief over death of her mother. Mother's death caused by chronic interstitial nephritis revealed at the autopsy, urinary findings having been absent till the fatal uremic issue. The child was of a very affectionate temperament, the pupils filled eyes, and she had a highly developed and easily irritated sympathetic nervous system. Attacks began with nausea and slight vomiting for a time followed by attacks which were violent and persistent, occurring almost every hour. Temperature ranged from 99° to 101° F. Vomited material consisted of frothy mucus and serum, very acid. The blood was not examined. The urine was loaded with excessive uric acid crystals and amorphous urates. At the end of the third day the face was pinched, heavy black rings under the eyes, eyes half closed, body quite drained of fluids and condition one of prostration and collapse. The pulse was 160 and very weak, requiring digitalis and strychnine hypodermically. The tongue was singularly clear and red. The abdomen was neither distended nor flattened, but about normal, although auscultation revealed an absence of peristalsis. There was present distressing thirst and hurried and irregular respiration, though hurried respiration, particularly at the time of vomiting should have little significance, owing to the proximity of the respiratory and the vomiting center. The treatment consisted of high enemas of saline solution and a hypodermic injection of morphine 1-18 gr. and atropine 1-500 gr. The diet consisted of panopeptone. The duration of the acute attack was five days. The after treatment was symptomatic, consisting of sedatives, eliminatives and tonics. During convalescence itching skin and eczematous rash over the buttocks suggested a blood irritant of the uric acid series. Thirteen weeks followed of irregular pulse and slightly elevated temperature, from 99° to 100° F., with no other explanation than a

marked disturbance of metabolism. This case seems to be properly classified as of the cyclic vomiting type, though there may never be a recurrence, for all necessary factors for recurrence may never again be present as in this instance of emotion from an unusual cause.

Differentiations from Other Attacks of Vomiting.

A condition most likely to be confounded with this gastric neurosis is the more ordinary recurrent bilious vomiting. The points of distinction are these:

BILIOUS VOMITING.

1. History improper feeding.
2. Unloading the bowels relieves.
3. Tongue coated.
4. Breath heavy.
5. Abdomen bloated and distended.
6. Abdominal pain and colic.
7. Abdominal peristalsis and with colic.
8. Stools often clayey.
9. Ordinary febrile urine.

CYCLIC VOMITING.

1. No such history; may occur with most careful diet with no symptoms of indigestion.
2. No such effect.
3. May be clean.
4. Breath late in attacks may have wine odor of acetone, but otherwise normal.
5. Generally about normal.
6. As rule, none.
7. Auscultation of abdomen, especially later in the attack, reveals absence of peristalsis.
8. Generally normal.
9. Urine scanty and loaded with uric acid crystals and amorphous urates out of proportion to other symptoms.

In cyclic vomiting, in conclusion, the excessive thirst, cyclic character, severity and persistence of the vomiting are quite pathognomonic. A differentiation of other causes of vomiting requires an examination of all the organs.

1. Vomiting may be due to local disease, irritation of the walls of the stomach itself, as in cases of any irritation as of medicine or of food in quantity or quality, overdistension with gas, congested mucous membrane, with irritating secretions, which cases reveal themselves by a study of the relation of vomiting to meals and a study of the material vomited.

2. Vomiting may be due to intestinal causes of quite the same nature as above or to such other abdominal causes as obstruction, peritonitis, appendicitis, which soon present very distinct physical signs and symptoms of these conditions.

3. It may be, also, reflex from other disturbance, as of cerebro-spinal system or of the special organs,—from brain disease, from the pharynx, eye or ear or almost any organ.

4. Vomiting may be central or toxic from an irritating state of the blood acting on the vomiting center, in the same manner as a hypodermic of apomorphine. This would include: Infectious diseases, which soon express themselves by well known symptoms or rashes and the vomiting is generally neither prolonged nor excessive and very frequently consists of but one or two explosive efforts. Among other causes of central vomiting may be included the toxemia incident to kidney disease.

In the vomiting of children it is always wise to follow two rules: (1) to examine the throat carefully, and not to be easily convinced that the cause is local, and (2) to determine whether there is an irritated or diseased stomach. Very frequently it is not at all of gastric origin.

The stomach, organic brain disease and organic kidney disease may represent the most frequent causes.

G. B. Butler says, "Vomiting is sometimes seen as the only marked symptom of an apparently slight nephritis. In such cases its onset is abrupt, its course intense and its outcome not infrequently fatal."

5. Simple or tuberculous meningitis may present greater difficulties, especially when we consider that vomiting may be rarely the only symptom of such a meningitis till a fatal issue by convulsions. The condition of the pupils, the eye grounds, irregular pulse and respiration assist the differentiation.

In the periodical vomiting which occurs in cases of *tabes dorsalis* in adults, a possible history of syphilis, the symptoms of station and patellar reflex and ocular symptoms are so characteristic that they cannot be confounded and are mentioned only because articles upon periodical vomiting refer to such neuroses, which are in no way related to cases of periodical vomiting now considered.

Other attacks of periodical vomiting, with abdominal pain, in adults, have been described in literature, but have none of the marked features of these attacks.

Still other conditions described as periodical attacks of vomiting in children are very plainly recurrent bilious attacks, in children careless of diet and hygiene, which have been described.

That the phenomena of cyclic vomiting are due to some toxic blood state seems certain, the exact nature of the toxin remaining in obscurity. It may be allied to the unknown toxin of uremia. It is probably of the xanthin series, one of the uric acid group.

The attacks resemble the so-called uric acid storms, described so graphically by Haig, in that the extremities are cold, glandular secretions decreased, and scanty urine and large excretion of substances regarded as uric acid.

The attacks differ in the fact that there is no headache or mental depression, and in the character of the pulse, which is not usually of high tension but weak and irritable like the pulse of toxin poisoning.

It is a pulse which can in no way be explained by the tension caused by impeded capillary circulation, which a colloid state of uric acid may occasion.

The symptoms are not so much of uricacidemia and the clogging of capillaries as of some toxin, possibly of the uric acid series, acting directly on the vomiting center.

The impressibility of certain nerve centers, and the difference of susceptibility of particular nerve centers in particular individuals help to explain the phenomena.

It is well known that toxins of the alloxuric group irritate particularly nerve centers, and that uric acid products are particularly injurious to nerve tissues, and we may be warranted in the assumption that some of these chief products of waste metabolism irritate the vomiting center in this gastric neurosis, though we do not know the steps of the biochemical process or the exact toxin. In all three cases, there is a neurotic or gouty, or a neurotic and gouty family history. In all three cases, the presence of amorphous urates and uric acid crystals in excessive proportion to the febrile disturbance point to a toxin of the uric acid series. In each instance, the alimentary tract and accessory glands seemed fairly normal and the auto-intoxication seemed not of intestinal origin but cellular, with perhaps faulty kidneys.

When we consider how little we know of the toxin of uremia, a condition more pronounced, more serious and more frequently at hand for study, we need not be chagrined at our lack of exact knowledge of the toxin in this gastric neurosis.

The treatment is sedative and eliminative. The indications are: First, to lessen the irritability of the vomiting center; and second, to eliminate. The first has been attempted by bromides and chloral by the bowel, which is not satisfactory. Nothing is so effective as hypodermics of morphine and atropine in severe cases. In less severe cases, cocaine and Fowler's solution lessen irritability both of the vomiting center and the peripheral nerve endings in the stomach wall.

Elimination is best accomplished by calomel dry on the tongue in small and frequent doses, in conjunction with high saline enemas.

Gavage has effected good results in young children. No other diet

than panopeptone or liquid peptonoids should be attempted for several days. In the interval there is indicated abundant fresh air and careful skin activity, exercise short of fatigue, an avoidance of nervous strain and child worry, with an anti-uric acid diet.

In conclusion, I wish to emphasize:

1. The importance of being watchful, on one's guard for the vomiting of this gastric neurosis, distinguishing it particularly from bilious vomiting and the vomiting of kidney disease and reflex vomiting, as of brain disease.

2. In children of gouty and neurotic history, the three cases reported point to a toxin allied to the uric acid series as the possible bloodirritant causing the vomiting.

3. The importance in severe cases of hypodermic injection of morphine and atropine, in conjunction with elimination, by high saline enemas, by gavage and, in extreme cases, hypodermoclysis and even intravenous injections of saline solutions.

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DISCUSSION.

DR. J. P. CROZER GRIFFITH said: Dr. Ely's paper, with its report of cases, has been very interesting to me, since the subject is one with which circumstances have brought me into somewhat close relation. It was my fortune—or misfortune—to observe 4 instances of this curious disorder up to the year 1900, at which time I published a paper upon the subject. Since then I have seen a very typical case with Dr. Sharpless, of West Chester, and another apparently incipient case with Dr. J. W. Marcy, of Merchantville. The name Cyclic, although striking and easily remembered, is, I think, not to be preferred. A cycle indicates some definite regularity in occurrence. This is not true of the affection under consideration. The word Periodical as a prefix also implies a certain regularity in return of the attacks. The name Persistent Vomiting, as it has been called by Rotch, may occasion some confusion, and it does not imply any tendency to return. It seems to me, therefore, that the title Recurrent Vomiting, applied to the condition by Gee, is perhaps the best one yet employed. The etiology of the disease is a most interesting problem. As yet we are more or less in doubt regarding it. Dr.

Ely's cases indicate that the affection may depend upon some condition allied to, or identical with, gout. An interesting paper by Comby, in the January number of the *Archives de Médecine des Enfants*, on Arthritism in Children expresses this same view, and gives recurrent vomiting as one of the manifestations of gout in the digestive apparatus. My own belief has been, and still is, that the affection is a neurosis, but that it is one of a toxic nature. Some poison the result of faulty metabolism becomes stored up in the system until, without discoverable reason, or sometimes depending upon some such exciting cause as overexertion, nervous strain, or the like, there is, so to speak, an overflow of the toxic agent, and the attack develops. The nature of this poison is obscure. Inasmuch as we are no longer even sure that gout is due to uric acid, or that uric acid is itself poisonous, we are still more uncertain about the cause of these curious attacks of vomiting, even if we admit that they are gouty. However, that there is some powerful poison at work seems manifest. The occurrence of a terminal nephritis in the last attack of 2 of my cases can be explained in no other way. Recently Marfan, in a paper in the November number of the *Archives de Médecine des Enfants*, has published cases of vomiting which he claims are due to the presence of acetone in the blood. The condition resembles cyclic vomiting in some respects. Acetone has been found in the urine of cases of undoubted cyclic vomiting. It is questionable, however, whether this substance is the cause of the vomiting or only an accompaniment of it. It is certain that the usual symptoms of acetonemia are not those seen in these gastric attacks. The symptoms of the affection are so striking that there are few other diseases with which this one can be confounded. The recurring attacks of violent, uncontrollable vomiting coming on without apparent cause, with the great prostration attending, the tendency to constipation, the absence of decided abdominal pain, the intense thirst, the anorexia, the feeble pulse and sometimes sighing respiration, form a picture, once seen, never forgotten and always dreaded. The occurrence of a second attack makes the diagnosis almost certain, the only condition closely resembling it in symptomatology being the Periodical Vomiting described by Leyden. This disorder, however, is purely a neurosis, being probably in all cases, and certainly in most cases, a manifestation of locomotor ataxia. In it abdominal pain is a very marked and constant symptom. Moreover, it attacks subjects past the age of childhood, who have reached the time of life when tabes dorsalis is most likely to develop. Still another condition could be confounded with it; the Gastric Attacks of Langford Symes, the Recurrent Gastric Catarrh of Soltau Fenwick. This, however, is clearly only an excessive development of the *Embarras Gastrique* of French writers. The attacks of vomiting in this disorder are rarely so severe as in the recurrent vomiting we are considering, and in any case they always clearly depend upon disordered digestion. In the first attack occurring in any given case of recurrent vomiting we have to distinguish the disease carefully from intestinal obstruction. The combination of repeated vomiting with obstinate constipation which often will not yield to medication is alike in each. The diagnosis may at first be impossible. In one of my cases intestinal obstruction had been strongly suspected by the attending physician. Perhaps a final

yielding of the constipation, unattended by the relief of the vomiting, or the continued absence of abdominal pain, or the failure of the appearance of bloody mucus from the bowel, may lead us to conclude that we are probably dealing with a condition primarily gastric rather than intestinal. I shall not take time to go further into the matter of diagnosis. The disease is, of course, to be distinguished from meningitis, from ordinary bilious vomiting, and from the vomiting which often characterizes the beginning of infectious diseases. Dr. Ely has already considered the matter carefully. A word with regard to prognosis and treatment. The prognosis is, on the whole, good, taking the cases as a class, but very dubious for each individual case. That death may occur I have already shown. As the child grows older there is probably a tendency for the disease to disappear. The experience of the profession with this affection is not, however, sufficiently extended as yet to make this certain. One of my cases has now had no attacks for a couple of years. In one of Rachford's cases migraine supplanted the vomiting as the child grew older. Treatment is often entirely unsatisfactory. In some cases nothing whatever appears to do any good. The nature of the affection must be clearly borne in mind, for since the vomiting is nervous in its origin, nothing is to be gained by the use of remedies directed toward a supposedly disturbed condition of the gastric mucous membrane; nor can we expect to stop the vomiting by having the bowels opened, inasmuch as the constipation depends upon the arrested peristalsis. This condition of the intestine is a nervous symptom produced by the same cause which has disturbed the action of the stomach. I am sure that it is a mistake, after the attack has once gotten under way, to devote much attention to the opening of the bowels. No food or medicine should be given by the mouth and the bowels should be reserved for rectal feeding. When, on the other hand, the attack is encountered at the very beginning, then the elimination of the poison may be attempted by procuring a free action of the bowels. I am sure that I have occasionally been able to abort attacks in this way. Of all the remedies to be used during an attack it seems to me that morphine, given hypodermically, affords the greatest hope of benefit. In one of my cases I am convinced that the use of this remedy saved the life of the patient. However, it is certain that some cases will not be benefited by it in the slightest degree. Chloral and bromides may, of course, be administered by the bowel, but morphine, given in the way I suggest, appears to me to be preferable. In the way of preventing attacks we can do little because we know so little what the cause is. It seems likely that fatigue and overexcitement are active in some instances. These, therefore, must be guarded against. Should the amount of urine secreted diminish and the bowels become sluggish it may be a warning that an attack is imminent. Free purgation by salines and the use of diuretics may then be of service.

DR. J. ALISON SCOTT referred to the nervous vomiting of the adult and of the child. Almost all were familiar, he thought, with the neurasthenics who were able to do almost anything with their stomachs, to eructate gas, reverse peristalsis and even produce scybala, if necessary. Nervous vomiting in the adult is not followed by such excessive symptoms as described in the

cases of Dr. Ely and Dr. Griffith. It produces moderate emaciation and oftentimes the subjects are in a fair degree of robust health. Gout, he believed, was sometimes attended with periodical vomiting. One patient, who had been frequently seen for some years, is for some days in succession accustomed to vomit in the early morning. The patient is of gouty descent, the parents for 3 generations have been gouty. She suffers from headaches which are relieved in a few minutes after vomiting. Dr. Scott had had personal experience with but one child, the offspring of 2 exceedingly neurotic parents, whose grandparents in addition were gouty. This patient, a little girl, vomited constantly for a week. Treatment seemed of no avail; recovery was uneventful and no recurrence has occurred. In reference to the presence in the urine of amorphous urates and uric acid, he believed that the urine so filled did not of necessity have an excess of uric acid or urates. The presence of uric acid crystals depends upon the acidity of the urine, upon the absence of pigmentation and sometimes upon a very high percentage of uric acid being present. Poverty in other mineral salts will produce uric acid very quickly. Against the theory that the vomiting is gouty, he said that uric acid is usually diminished in gout. It seemed to him probable that the vomiting was the result of uric acid toxins.

DR. H. S. ANDERS said that it seemed to him that the effort made to help these cases should be based upon the practical and scientific way of trying to find whether the vomiting was nervous or cyclic, and the specific, definite or direct cause of the vomiting. It is usually considered that the cases purely neurotic in origin were those in which there was the absence of any disagreement of food with the stomach, or in which there was no evidence of organic gastric affection. The presence of gouty and neurotic history combined was helpful in diagnosis. It was usually found that when cases were said to be more or less purely neurotic they might be recognized by the fact that there was no premonition of the vomiting coming on, and also that there was no marked change in the gastric contents. The patients bear the vomitings well, except when they become prolonged, spoken of by Tuckwell as habit vomiting. In a case reported by Gardner some years ago, a child was subject to recurrent vomiting at intervals of 2 or 3 days in a month, lasting for 24 hours at a time. At 11 years the child developed chorea. He thought it very likely that many of these cases of cyclic vomiting were traceable to the underlying neurotic condition which leads to chorea and allied nervous affections. In the one case which he had seen there was a distinct gouty-rheumatic history in the parents, and the child too had an excess of urates in the urine. An interesting feature of the case was that with the recurrence of vomiting there was coincident occurrence of excessive urination. The polyuria amounted to 60 to 80 ounces in the 24 hours. Rumination had been noticed in a boy of 16, of extremely neurotic type. With the greatest ease he could regurgitate his food, chew and swallow it, and he said it tasted as good as at first. Such cases were apt to be of neurotic character, and tended toward idiocy although decided evidences of moral insanity characterized this case. Reference was made to the statement of Max Einhorn that many of these cases are seen in girls, and that the hysterical element may be at the base of many of them.

In one girl at the age of puberty the stress of school life caused attacks of vomiting, though her general health was unimpaired.

DR. D. J. M. MILLER said that he thought that a distinction could not be so clearly drawn between nervous vomiting and biliousness as Dr. Ely had endeavored to do. A great many cases of the so-called bilious vomiting are of the same nature as the cases of recurrent vomiting. He thought the toxic nature of the affection was shown by the fatal cases. He had seen one or 2 cases in which the attack terminated in nephritis. It seemed to him that no treatment was of avail. After the attack had begun he believed that the less given by the mouth the better it was for the patient. Sedative remedies combined with nutrient enemata, are the only ones of value. In one case chloral and bromide were given by the rectum. The patient went to sleep for 12 to 15 hours and upon waking the attack was over. Another case had been treated by bromide and laudanum with a similar result.

DR. ELY, in closing, said that he agreed with Dr. Griffith in the importance of feeding by the bowel, and with Dr. Scott that the amount of uric acid found in the urine did not prove very much. He thought all were agreed that the cause of the disease was some toxin. He had attempted to prove that this toxin was not from the alimentary tract, but was probably due to faulty metabolism, concerning which but little is known.

The Treatment of Cyclic Vomiting in Children.

BY ALFRED HAND, JR., M. D.

[Read at the South Branch, May 30.]

The general subject of cyclic vomiting has received such thorough consideration of late that it is my purpose to discuss at this time mainly the treatment, touching upon the etiology and symptoms only so far as it is necessary to explain the points of treatment.

Cyclic vomiting may be looked on as one of the purest manifestations of auto-intoxication which occurs, at least in pediatric practice. As is well known, auto-intoxication in its strictest sense does not depend upon infection at all, germs not taking part in the production of the poison or poisons. These poisons have several possible sources; they may be manufactured in the intestinal tract through a fault in the chemical processes of digestion; they may be produced in the tissues of the body, through imperfect oxidation or other metabolic processes, the usual channels of elimination not being adequate to the unusual demand; and finally, the fault may be in the emunctories, the retained products of normal tissue change accumulating until set free by a storm of vomiting. My own belief is that, so far as these divisions can be made, the three cases I have seen belong to the second

class, for the reason that in the intervals between the attacks there was discovered no fault of digestion, absorption or elimination; the tongue was clean, the appetite good, the diet rational, the bowels regular and the passages gave no evidence of imperfect digestion; the urine, in reaction, specific gravity, absence of albumin, sugar and formed elements, gave no indication of disease, and yet there was being stored up in the body substances which accumulated until they reached a certain level when they were siphoned off, so to speak, by a prolonged, prostrating attack of vomiting.

A second point in the etiology has been impressed on me by all my cases, the influence of heredity being unusually strong. The father of the first patient was said to be gouty; both the parents of the second patient are subject to gouty headaches; and the mother and maternal uncle of the third one were subject in childhood to attacks of so-called bilious vomiting. This is a point to be taken into consideration in managing such children, although it is, of course, not amenable to direct treatment; its value is in showing the need for prolongation of the hygienic treatment.

It is customary to look on the stomach as an organ of digestion and absorption, but it is infrequently thought of as an organ of elimination; that this is sometimes the case has been shown by Erlenmeyer with reference to the course of morphine in the body; he attributes the discomfort coming on when the effects of a dose are wearing off to the elimination through the gastric mucosa of an oxidation product of morphine, lavage removing this and adding to the comfort. Viewing cyclic vomiting as produced in a similar way, it is easy to see why gastric sedatives and ordinary purgation, if this can be accomplished, are utterly useless and also why the two measures for relief which have seemed to me to be useful are rational. I do not mean to imply that the poison causing the vomiting is eliminated solely by the stomach, as the urine undoubtedly contains uric acid and perhaps other bodies in excess. But that the stomach acts as an excretory organ seems reasonable from the fact that when it is emptied time and again in the course of an attack there will still be brought up, without any liquid having been taken in the intervals, an appreciable amount of a clear, mucoid fluid, sometimes tinged with bile; Holt states that this is acid in reaction.

The first patient whom I saw in an attack of this kind was a girl, six years old, and for some time I did not recognize the true nature of the condition. As one thing after another was excluded, I decided that it must be nervous or toxic in origin, and on consulting Holt's text-book, found his description very accurate. Calomel, bismuth, counterirritation and what-not had been tried and put aside and the

child's condition was growing alarming, with prostration and pinched features; I meditated practicing lavage, but as the procedure is very formal for a child of six years, I resorted to copious draughts of salt water, with the idea of washing out this clear fluid of which there seemed to be a considerable supply in the stomach. To my surprise, the child immediately felt easier and retained the glassful for about an hour, when only part was returned. The urine had been scanty, with a trace of albumin and a sediment of hyaline casts, uric acid, leukocytes and cylindroids, but it became more abundant as the salt-water draughts were repeated, and in a few days the child was back to her usual state of health.

The second case I saw was in a physician's child, a boy five years old, whose sister was reported to have had similar attacks and to have died in one, with the development of a hemorrhagic nephritis; this boy had had a number of attacks of increasing severity and frequency, and when I first saw him, he had been vomiting for two days and was much prostrated. I advised giving nothing by mouth except salt water (half a teaspoonful of salt to a glassful of water), and when I saw him six hours later improvement, perhaps only coincidentally, was decided. He seemed to crave the salt water and vomited it only occasionally. Two months later he had his next attack when I was out of town; the next after this occurred in six weeks and the picture he presented was as alarming as anything could well be; the salt water was used freely and acted as before in lessening the discomfort of the boy and in increasing the flow of urine which, at the start, was very concentrated and loaded with uric acid crystals. This attack lasted four days, and with the family history in mind both the father and myself thought that the salt water possibly averted the development of a nephritis. With the dread of another attack stimulating us, we thought it desirable to find something which would tend to abort the attacks; with this end in view we turned to the alkalies and selected milk of magnesia as one probably suited to neutralize the acid substances in the stomach. The father has reported to me that on two occasions since then, with the first act of vomiting, he has administered two teaspoonfuls every half hour until the bowels moved, apparently aborting the attack at once. I do not believe that this is a specific any more than I do that the salt water is, but I do believe that they are useful additions to our means of treating this condition, and they are means which can by no possibility aggravate the condition or injure the patient.

With the exception of these two things, I agree with the statement of the text-books, that no food or medicine should be given by mouth. The other avenues of medication, the skin and the rectum, may be

used as occasion requires, the measures recommended being hypodermic injections of morphine and atropine, enemas of bromide and chloral and of peptonized milk. With regard to the last, my own idea is that this attempt at feeding is unnecessary because absorption by the rectum seems as much at a standstill as by the stomach, all the functions of the body save elimination seeming to be suspended, except for a bland substance like normal salt solution. This may, therefore, be used to advantage by the rectum as well as by the mouth.

As so much of our knowledge of the condition is theoretical, the hygiene during the intervals between the attacks can only be put down as general, while, in practice, it demands a thorough study of the individual child; this subject is one to be considered separately.

Saline Infusions and their Administration for Meningeal Symptoms in an Infant.

BY ALFRED GORDON, M. D.

[Read May 14.]

The study of the humoral substances of the body in their physiological and pathological states led to the discovery of certain powerful agents in treatment of infections and intoxications. As the blood is the principal agent that carries toxic products through the whole economy, the main effort in cases of infection consisted, therefore, of attacking not only the micro-organism in its seat of development, but also the poisons brought with the blood to various organs. Thus we have the antiseptic therapeutics and that of antitoxins; while the first is only palliative, the last has a neutralizing effect. The rationale of treatment of all sorts of infections consists of applying a remedy to counteract the toxins circulating in the blood; the antitoxic serums will be the ideal. Unfortunately the antitoxic treatment within the limits of our present knowledge can be applied to but few infectious diseases and until more specific serums shall be discovered, we must have recourse to other means in order to eliminate the accumulated toxic product from the blood. The old bleeding and purgation, despite their excellent effects, are not sufficient in many cases, in which a direct, rapid and energetic result is immediately sought for. The last we find in saline infusions.

The practice of saline infusions is a direct derivative of transfusion. In hemorrhages of a grave character transfusion of blood was used to a large extent, but this way of managing great losses of blood is almost abandoned because of the difficulty and danger of the pro-

cedure. It was necessary to substitute for it a solution which should have about the same chemical composition as the bloodserum, but which at the same time would be nontoxic and not ruinous to the elements of the blood. This fluid introduced into the circulation of an individual whose vessels are almost empty after a hemorrhage, would stimulate the circulation.

Although the exact action of the infusions is not yet known in all its details, we, nevertheless, must admit that their main purpose is to change the condition of the circulating fluid and increase the bloodpressure.

The subcutaneous or intravenous injection of saline solution presents, nowadays, a mode of treatment in some cases so efficacious that there is no physician or surgeon that would not be ready to have recourse to it again and again after he gave it a trial. Some writers, however, reported, it is true, accidents following saline infusions, but this was rather due to the method employed or to some fault of the technique. A point which should be really taken into consideration is the quantity injected, because in the majority of cases unfavorable symptoms were the result of a superfluous amount of the fluid. At all events, if occasionally we meet with undesirable though not fatal symptoms, they are transitory in character and insignificant in comparison with the brilliant services that the saline infusions may render.

The field of usefulness of saline infusions widens more and more. That hemorrhages, puerperal and others, can be arrested by them, is too obvious to dwell upon. A sufficiently large number of observations are accumulated to warrant their use, when other means do not succeed.* In cases of operative shock and diabetic coma saline infusions also proved valuable.

A particular interest in this respect we find in treatment of infectious diseases. Cholera, typhoid fever, pneumonia, gastro-intestinal infections—are the diseases that were reported to be greatly benefited by this mode of treatment. Here the rôle of the artificial serum is that of a lavage of the blood with the result that the toxins are eliminated by the kidneys, bowels, skin, etc., and the various symptoms of disturbed functions of different organs will therefore be removed. Cerebral symptoms due to intoxications of gastro-intestinal origin can be greatly allayed by the administration of artificial serum. Administered as a last resort in some forms of meningitis it gave excellent results. In the literature at my disposal I found only three cases of secondary meningitis treated by this means. The case that

*A. Gordon. Intravenous injections of artificial serum in puerperal hemorrhages. *Annals of Gynecology and Pediatrics*, April, 1897.

I am about to report is one of the most striking. After all possible means failed and hope was entirely abandoned, a normal saline solution resuscitated, I may say, my little patient to the great surprise of everyone who had charge of her.

Infant H. L. G., 5 months of age, passed through a rude experience in trying to accommodate her gastro-intestinal tract to various forms of milk. She often had attacks of indigestion of short duration. During her last illness the following points were noted. One morning symptoms of intestinal indigestion began to appear. On that day the infant had about 5 or 6 stools, though not abundant. She looked weak, but there was nothing alarming in her condition. Her mother, a woman of intelligence, knew how to take care of the case. She suppressed the milk at once and with a skillful management succeeded in reducing the number of stools to 2 or 3. The child began to improve. Nevertheless some members of the family, from overanxiety, induced the mother to call a physician, who with one stroke discarded the mother's wise treatment, readministered the milk, and in addition to this prescribed a drug which checked totally the movements of the bowels. The child had not had a passage for several hours and passed no gas. Then the patient's condition changed entirely. She refused to take the bottle, and when fluid was poured into her mouth, she rejected it, not being able to swallow. Her usual intelligent look disappeared, and the child seemed to go down rapidly. The doctor called again, and advised the continuation of the same treatment. The condition, of course, looked more and more unfavorable. Several hours later the doctor gave up the little patient, saying nothing could be done, and she must die.

These were the circumstances that I had to face, when I was called in. Before I could reach the town, where the patient was located, several hours elapsed. I found the little being lying motionless in the crib; the tip of the nose white and cold, the breath lost its natural warmth, lips pale, and the tips of the fingers bluish, the adipose tissue of the orbits disappeared, the eyeballs sunken back into the orbits, body cold, pupils slightly dilated, reflexes very much diminished, extremities flaccid, heart-beats rapid, but weak, pulse very small. I learned that there was no movement of bowels, no gas passed through the rectum; also no urine was voided during the last 8 or 9 hours. The outlook certainly was grave, and at no moment did I expect recovery.

During the following 7 hours the patient was kept surrounded with artificial heat and low and high warm enemata were administered repeatedly. Sweet spirit of niter was deposited on the tongue drop by drop, also some fresh bouillon. At the end of that time the child urinated but a very small quantity. The body gradually became warmer. A ray of hope appeared. Unfortunately the scene changed entirely; suddenly the little patient became rigid, took a position of opisthotonos, the neck became extended, so that it was impossible to flex it, her eyes rolled up and fixed in convergent strabismus, the arms flexed rigidly, abdomen retracted. The body temperature at that moment was 104° and pulse filiform. The superficial and deep reflexes were all markedly increased, ankle-clonus on the right side.

The meningeal symptoms persisted from 7 A. M. to 3 P. M., during which time the child was placed in warm baths and warm rectal injections of salt water were administered. The rigidity would disappear for a short time and reappear. As there was no trismus sweet spirit of niter and warm bouillon were poured drop by drop in the mouth. Some was swallowed and some rejected. During the 8 hours the struggle between life and death was great. The temperature oscillated between 103° and 104°. Ice was kept on the head. The pulse was very small, filiform and at times it seemed to me imperceptible. The breathing was very superficial and rapid. The lungs were free from rales. Whenever the pulse would become more imperceptible, I would inject hypodermically a few drops of ether and then it would come up. Occasionally slight clonic spasms would appear in the lower extremities. As there was an evident toxemia causing the meningeal symptoms, all my thoughts were directed to some means that would help to eliminate the toxin circulating in the blood and irritating the cortex, as well as the base and the membranes of the brain. As the meningeal symptoms persisted at the end of the eighth hour, I decided at once to have recourse to saline infusions. The nurse was ordered to prepare a normal solution (7 per 1000) with filtered and boiled water. I poured it in an ordinary fountain syringe, attached the rubber end of the tube to an ordinary hypodermic syringe, the piston of which was removed, and inserted the needle in the outer aspect of the left arm. The quantity injected at first was about 15 cc. I waited for the effect while watching the patient. Within about 10 minutes after the fluid was absorbed, the patient's face changed. The first effect showed itself in the quantity of urine, which became more abundant. The strabismus had a tendency to decrease, also the rigidity of the neck. The temperature gained a few tenths, but later went down to 102°. Pulse became more rapid and fuller, the breathing less frequent. Unfortunately the condition lasted but one hour. Encouraged by the effect thus obtained, I readministered the same quantity, and again the same immediate effect, but this time the good result was maintained. To avoid repetition I shall say that the most marvellous effect of the infusion was manifested in the function of the kidneys and the circulation. I had no difficulty in perceiving the heart beats; the pulse, although more frequent, became full and strong. The patient began to urinate very frequently. In order to assist the elimination I administered then a high rectal saline enema and evacuated an abundant amount of dark fluid feces. Patient soon afterward became covered with a profuse perspiration, the strabismus and rigidity of the neck gradually disappeared, only a slight stiffness remained yet in the lower extremities with increased knee jerks. The pupillary reflexes reappeared, the face regained its natural color and the extremities became warm.

As the object of this paper is to report the effect of the saline infusion in a case with meningeal symptoms, I will not go into the details of the convalescence. I shall merely mention, that it was extremely slow, but at no time was there a recurrence of the symptoms. The child is living and in perfect health.

Such was the result of the saline infusions. It is not my inten-

tion to describe the technique or to enter into discussion of the theories concerning the intimate effect of the artificial serum upon the blood and tissues. I wish only to report a fact.

A few points, however, deserve our attention. Firstly, there is no doubt that the fluid injected washed out and carried off the toxins by the way of the different emunctories. Secondly, the case teaches us that sometimes a very small quantity of the saline fluid is sufficient to accomplish the lavage of the blood. Finally, it is also evident that the remedy acted as a stimulant to the circulation, to the nerve centers and as a powerful diuretic.

From the general standpoint I wish to emphasize a fact observed also by many writers and corroborated by my case, namely, the effect of the infusions is marked soon by an elevation of the temperature and acceleration of the pulse; this is the so-called "period of reaction." In cases of profound intoxications the reaction is very pronounced.

If these statements are correct, will they not serve as means for prognosis? I mean to say that when the immediate reaction of the saline infusion is insufficient or absent, repeated infusions are indicated.

DISCUSSION.

DR. H. A. HARE referred to the use of sweet spirit of niter in Dr. Gordon's case as a diuretic. Although the use of the sweet spirit of niter had been resorted to for years the fact was generally overlooked that after all it acts like nitroglycerine, and its physiological action in such cases depends upon the nitrite which it contains. In other words, had the patient received minute doses of nitroglycerine similar results would have been produced, the well known action of the nitrite dilating the renal bloodvessels which are in spasm and allowing urination to take place. Toxic material absorbed from the intestines he also believed caused spasm of the bloodvessels, which was relieved by the treatment instituted by Dr. Gordon. It seemed to Dr. Hare that the remedy possessed more importance than would be supposed by a superficial glance at the treatment. In regard to the use of transfusion, the treatment was based upon the same lines. The condition was one of toxemia, and the flushing of the kidneys and perhaps the capillaries of the skin enabled the child to get rid of some of the toxins which were destroying life. The case is also important in that it illustrates possible recovery in a case of this type developing meningeal symptoms. Dr. Hare's experience had been almost without exception that if a child with summer complaint developed marked meningeal symptoms, recovery was exceedingly rare. He did not refer to the mild hydrocephalic symptoms, but to marked symptoms with opisthotonos, strabismus and other symptoms mentioned in this case. Another point emphasized by Dr. Gordon, but which had not received deserved attention, was the fact that small quantities of salt solution were injected. The

medical profession is prone to believe that if a little does good, more does better. The present tendency is to almost drown the patient with salt solution given hypodermically. As a matter of fact, small quantities seemed to act equally well. One reason that good results were not always obtained from hypodermoclysis, Dr. Hare believed, is failure to remember that the vascular system is an elastic one. As a matter of fact, it was well-known that normal bloodvessels will contain about twice the quantity of fluid over and above the blood which they contain. In the employment of hypodermoclysis he thought there should be the simultaneous use of measures to restore the vasomotor tone of the vessels.

DR. S. SOLIS COHEN said that he had been using salt solution for more than 10 years and had not been disappointed with the results. Not only should the solution be small in quantity, but it should be introduced slowly. He has seen harm done by the use of large quantities of fluid thrown into the circulation quickly with which the heart and lungs could not deal. From 4 to 6 ounces introduced during 15 minutes he considers about the proper quantity for an adult.

DR. GORDON, in closing, said that the slow method of introduction of salt solution was the most valuable. A large quantity may be needed in surgical cases, especially in abdominal surgery, but in purely medical cases there is not the same necessity. The patient should be watched lest any unfavorable symptoms arise. If these symptoms return the injections should be repeated. In a case of status epilepticus Dr. Gordon used small quantities of saline solution which produced a marvelous effect; the intervals between the attacks were prolonged. The results of the attempts to eliminate poisons are, to a certain extent, in favor of the toxin theory of the so-called idiopathic epilepsy. In puerperal eclampsia and delirium tremens excellent results have also been obtained. Dr. Gordon thought that his own case showed conclusively that age was not a contra-indication to the use of saline solution.

A Case of Deformed Nose Treated by Subcutaneous Injection of Paraffin.

BY JOHN B. ROBERTS, M. D.

[Exhibited May 28.]

The case was one of successful reconstruction of the nose by the injection of melted paraffin under the skin of the dorsum. The man had been kicked in the face by a mule and had sustained a fracture of the nose, leaving a saddle-like deformity.

The operator used a hypodermic syringe and injected melted paraffin into the tissues over the depressed nasal bones. The paraffin, which had a low melting point, was moulded into shape by the fingers before it solidified.

This method, devised by Guernsey, is very satisfactory for filling out depressed portions of the body, such as the nose and the cheeks.

The paraffin becomes encysted and remains in the tissues as an innocuous tenant.

The patient was greatly improved and there had been no inflammatory reaction. The outline of the nose was much improved and the patient greatly gratified. This method may be utilized in other ways. It may prove serviceable in strengthening the abdominal wall at hernial rings and thus be employed for the radical cure of hernia. A test may be made of its efficacy in closing openings in the skull after trephining.

The injection is made with the tissues at their normal temperature. The paraffin is so prepared that the melting point is low, though not as low as it ought to be. The druggist had undertaken to make it liquid at 104° or 105°, but he had had difficulty in getting the exact melting point. It solidified a little too soon, and when the edema disappeared two small nodes could be felt under the skin. These, however, the patient regards of no importance.

DISCUSSION.

DR. B. ALEXANDER RANDALL exhibited a drawing showing the condition before and after injection in a case on which he had operated. The result had been very satisfactory, and as in Dr. Roberts' case, there was no reaction. In these cases there is lack of the proper lifting of the bridge tissues of the nose, and abnormal lifting of the tip of the nose and curious, heavy rugæ under the eyes. The rugæ, however, disappear when the nasal bridge tissues are lifted and the tip of the nose is depressed by the insertion of the paraffin. To maintain the fluidity of the paraffin Dr. Randall wraps the syringe in a towel dipped in scalding water. He believes the operation will prove to be satisfactory in some of the cases in which the bone operation could not be tolerated.

The Dangers of Inflating the Stomach with CO₂ Gas. Its Diagnostic Value. Report of Three Cases with Autopsies.

BY MOSES BEHREND, A. M., M. D.

[Read May 28.]

It is a remarkable fact that in a vast amount of literature reviewed not one case has been reported in which death can be directly ascribed to the use of carbon dioxide gas in inflating the stomach. The test has been used extensively in the last decade by many observers. Von Ziemssen and Mankopf have been strong advocates of this method; Mankopf and von Frerich being the first to use it. They advise it because of the sudden distension of the stomach which

this gas causes, whereby the contour is easily outlined and the various displacements and morbid processes are thus more readily diagnosed. This is undoubtedly true, but the dangers following this explosion must be attributed to the sudden evolution of gas over which we have no control.

Referring to the CO₂ method of inflating the stomach, Ewald says: "These methods suffer from the disadvantages that we have no control over the amount of gas produced after the salts have been introduced into the stomach or intestines, that disagreeable accompanying symptoms frequently arise from the irritation of the CO₂ gas upon the walls of the stomach or intestines and that, even though varying quantities of gas are needed for different persons, the degree of tension produced cannot be regulated at will or increased at a given moment."

Ewald, again, in quoting Osler, Meinert and Riegel, states that these men have not noted any unfavorable results from this method. Schütz believes that a better examination can be made with CO₂ gas than with the inflation by air on account of the sudden distension produced by the former procedure. Opposed to him are Runeberg and Oser, who inflate the stomach with air by the passage of the stomach tube. They believe that in this way the degree of the distension of the stomach can be well regulated. No one will doubt this, but this method is not without its dangers and disadvantages. The passage of the stomach tube is the main objection, especially with private patients.

The use of CO₂ gas in office practice for diagnostic purposes was recently mentioned by Elsner. Steele uses both to a considerable extent at the University Hospital. The practice of using these methods in the office and dispensary, should be condemned.

The disastrous results obtained from the use of CO₂ gas for diagnostic purposes has led the writer to report the cases under his observation while interne at the Philadelphia Hospital. The method under discussion is certainly of diagnostic value, as in all the cases the situation of the disease was located before death.

A diagnosis being difficult in the three cases led to the employment of CO₂ gas. The usual technique was followed. About one dram each of tartaric acid and sodium bicarbonate was dissolved in half a glass of water. The sodium bicarbonate was given first, followed immediately by the tartaric acid solution. Almost instantly a swelling was noticed in the epigastric region in one case. In all three there was a sense of oppression, followed by depression and a condition resembling shock.

In the first case just mentioned hemorrhage resulted, causing death of the patient twenty hours after its use.

CASE I. M. P., aged 68 years. Admitted to hospital 5-2-'01. She was sent from the outwards with a history that she has been in bed at intervals for several weeks and that she vomits after taking food.

The chief complaint on admission to the hospital was weakness and inability to keep anything on her stomach. Her family history was unimportant. She had malaria, yellow fever and rheumatism. Menstruated at 13. Always regular. Menopause not known.

The present trouble extends over a period of 12 months. At that time I saw the patient in the outwards and then she had symptoms referable to the stomach. She was well nourished but pallid. Marked cardiac arrhythmia was also present; this was absent on admission to the hospital one year later.

Now she vomits immediately after eating, appetite gone, marked eructations of gas, bowels variable, headache, vertigo, palpitation, some dyspnea, and pain across the epigastric region.

PHYSICAL EXAMINATION. Patient is a very much emaciated old woman; skin universally wrinkled; chest capacious, costal angle obtuse; breasts atrophied, though pendulous; abdomen scaphoid. Heart sounds are weak though rhythmical. Lungs are emphysematous. Abdomen: Liver and spleen apparently normal in outline. Tenderness in epigastric region. No mass can be felt.

5-7-'01. She is getting gradually worse, vomiting everything eaten. No blood is noticed. Drugs do not relieve her at all.

5-12-'01. No diagnosis having been made, it was decided after consulting my chief, Dr. W. E. Hughes, to use the CO₂ gas to inflate the stomach. Immediately after its use the patient was greatly distressed, tossing her head from side to side and making special efforts to throw off the gas. About half an hour afterwards she vomited a quart of blood and at irregular intervals during the course of twelve hours large quantities of blood were ejected. Patient lived twenty hours after taking the seidlitz powder. At the time of her death she was exsanguinated.

AUTOPSY BY DR. FLEXNER. *Pathological Diagnosis:* Ulcer of stomach, hemorrhage, general anemia, adhesive pericarditis, chronic nephritis, small granular kidney, atrophic cirrhosis, cholelithiasis, nephrolithiasis, acute peritonitis, cyst of ovary (left). That part of the autopsy relevant to the stomach condition will be described. Loops of intestine are distended, dark in color, tissues of lesser omentum are infiltrated with small recent hemorrhages. Stomach: Old adhesions on left side between fundus and spleen and between spleen and diaphragm. Stomach is not dilated, greater curvature shows a series of fine linear ulcerations. These are arranged in a radial manner about the esophageal orifice and average 4 cm. below the orifice. They extend into the submucous coat. They vary in length from 3 to 4 cm.; and in width from 4 to 6 cm. Their edges are elongated and slightly puckered. In middle of base of one a small mass of necrotic tissue is seen. In addition to these there occur on the anterior surface of stomach about the middle of the lesser curvature, but near the esophageal end, a recent ulcer on which a recent clot sits. This ulcer, as far as can be made out, is triangular in form, measuring at its base 4 1-2 cm. Its edges resemble those already described. At the apex

of this triangle it is surrounded by two semicircular lines of ulceration; the larger one at the right extremity connected with an anastomosing ulcer also linear in form, which is placed a little nearer the pyloric extremity. The serous coat corresponding to the necrotic focus is covered with fibrin. On moving this clot the interior of the stomach is reached. Necrotic serosa only separates it from the lesser cavity on the peritoneum. The ulcer is 4 cm. from the esophageal and 11 cm. from the pyloric extremity. The remainder of mucous membrane, especially about pylorus, is mammillated.

The immediate result, as shown by the post mortem record, was the rupture of a bloodvessel at the base of an ulcer from which fatal hemorrhage ensued. The fact that this happened in the first patient on whom the CO₂ test was tried was an unfortunate circumstance, but believing it to be an unavoidable accident it was determined to give the test a fair trial.

It was hardly expected that in a patient, almost seventy years of age, an ulcer should be found. The vomiting occurring immediately after eating should probably have pointed to an ulcer of the stomach, but in another case in which the same symptom was present a different condition was found.

II. G. S., male, aged 73 years, was admitted to hospital 6-21-'01. His chief complaint was vomiting after eating. His family history was negative. *Previous History:* Had the usual diseases of childhood. Typhoid fever three years ago. No venereal disease. Always been a free user of beer. *Present History:* Eight years ago trouble began with vomiting immediately after eating. This has persisted up to the present time. Can retain nothing except a little hot milk. Has no pain in stomach; no vomiting of blood.

PHYSICAL EXAMINATION.—Patient is an old man very much emaciated; a German. All bony outlines are prominent. Pupils equal and react to light and accommodation. Tongue is pale, pulse irregular in volume, arteries compressible though thickened. Chest well-formed but extremely emaciated. Abdomen is scaphoid. Lungs: Hyperresonant; vesicular murmur and vocal resonance diminished. Heart: Outline difficult to obtain on account of hyperresonance; sounds at apex show a slight systolic murmur. Abdomen: The only thing felt is a prominent pulsating aorta. The muscles in the neighborhood of the stomach are very rigid, rendering palpation unsatisfactory. Liver dullness limited to a narrow zone of 2 inches.

6-28-'01. Patient is getting weaker, vomiting almost every thing eaten. Dullness at interscapulovertebral space. Esophageal bougies pass easily; larynx apparently normal. A small tumor is seen on pharyngeal wall.

6-19-'01. To-day the CO₂ test was tried on patient. A large quantity of froth and a little blood were vomited or rather regurgitated immediately. After giving it the stomach was not distended. The patient was extremely prostrated immediately after its use, and never rallied. He died on the following day.

AUTOPSY BY DR. PEARCE. *Pathological Diagnosis.* Carcinoma of the esophagus and stomach, cholelithiasis, pericholecystitis. The stomach is small, distended with a little gas. At the junction of the esophagus and stomach a hard mass may be felt externally. Esophagus shows agonal digestion in its middle part. Beginning 5 cm. from the cardiac orifice there is a mushroom like tumor, soft in consistency, taking in entire diameter. This is continuous with a similar growth extending to the stomach at orifice involving the entire circumference. The central portion of both tumors is ulcerated and the ulcers are surrounded by this soft, elevated, mushroom-like growth. Surface is much pigmented and of a slaty color.

The fact that the gas generated by the powders did not distend the stomach, fixed the diagnosis above or at the cardiac end of that organ, and the clinical diagnosis of carcinoma of the esophagus and cardiac end of the stomach was made during life.

The diagnosis of the situation of the lesion in the previous and the next case to be reported was made because of the absence of epigastric fulness that follows the ebullition of the CO₂ gas in the stomach.

As it is always desirable to make a diagnosis during life, this is an important point, but the danger connected with its use offset its utility. To illustrate the localizing power of CO₂ gas the next case is a striking example.

III. C. M., colored, aged 52 years. Admitted 4-12-'01. Chief complaint, pain just below and to the left of the sternocostal angle. Nothing is known concerning his family history.

PREVIOUS HISTORY. Measles, mumps and whooping cough in childhood. Jungle fever, in Calcutta, in 1869. Denies venereal infection.

PRESENT HISTORY. For years patient has had a feeling of discomfort at the point above mentioned. After eating there would be a sensation as of the esophagus being dilated. Ever since an attack of influenza 6 weeks ago his trouble has been exaggerated. Lost much weight. Appetite very poor.

PHYSICAL EXAMINATION. Patient is very thin. Sclera is of a muddy color, tongue is brown. Pulse regular. Chest: Musculature poor, chest spare, all bones prominent. Abdomen: Retracted, doughy consistency. At intercostal angle there is tenderness, but no mass can be made out, the pulsating aorta is easily felt. Right rectus muscle is very rigid. Heart and lungs show nothing abnormal.

4-22-'01. Emaciation extreme, voice husky increasing in intensity from day to day. Examination by Dr. Gleason shows paralysis of vocal cords and chronic inflammation of the mucous membrane.

4-26-'01. Patient is getting weaker, he is taking very little nourishment, vomited a quantity of black fluid with clots. Microscope showed latter to be blood.

5-19-'01. No change since taking of last note except the increasing emaciation and weakness, no vomiting. The CO₂ test was given to-day, no change noted in the abdomen, stomach apparently not affected.

The distress noted in Cases I and II was seen here. The patient seemed dazed after its administration and he was in a more or less semiconscious condition till the time of his death on 5-24-'01.

CLINICAL DIAGNOSIS. Carcinoma of the esophagus.

AUTOPSY BY DR. PEARCE. *Pathological Diagnosis*, dilation of esophagus, suppurative of tracheal lymphnodes, chronic diffuse nephritis, chronic pleurisy, edema of lung, chronic splenitis, atrophy of right testicle. Esophagus dilated throughout the entire extent, 31 cm. Greatest dilation at cardiac end with circumference of 18.3 cm., in middle 15 cm. below the beginning circumference is 12.5 cm., mucosa thickened showing irregular, elevated, grayish finely-granular plaques between which are depressed smooth black areas. This appearance is uniform throughout the entire extent. The glands about the trachea and esophagus are greatly enlarged and contain soft puriform almost cheese-like substance. The largest of the softening glands measure 5 by 3 cm. There is no calcification and they do not suggest tuberculosis; no condition is found which would explain dilation of the esophagus by traction. The recurrent laryngeal nerve courses over the enlarged glands.

All these cases are interesting on account of the pathological findings; the dissimilarity of lesions with like symptoms is unique; the fact that vomiting did not occur immediately after eating in Case III is on account of the extreme pouch of the esophagus.

It must be evident from these observations that the use of CO₂ gas in inflating the stomach is a serious matter. It is infinitely more dangerous where there is disease of the esophagus and cardiac end of the stomach. This may be due to the pressure exerted within narrow limits. The test must be used, if at all, with discretion and the cases must be selected. The lives of all the above patients were undoubtedly shortened.

I wish to extend my appreciation and thanks to Drs. William E. Hughes and H. B. Allyn for their kind permission to use the cases, without which this paper could not have been written.

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DISCUSSION.

DR. WILLIAM E. HUGHES said that he thought the profession was rather prone to use CO₂ gas blindly to dilate the stomach. Since the danger had been called to his attention, he had introduced Seidlitz powders into the stomach during post mortem examinations and it was found that there was not sufficient dilation of the organ to put any of its tissues on tension. Although diagnosis of stomach conditions is facilitated by dilation of the organ, yet this test is not entirely reliable. He regards dilation through a stomach tube as a very much safer procedure.

DR. A. P. FRANCINE referred to the experience of Dr. J. Dutton Steele and himself in this method of dilation of the stomach, which they had found unsatisfactory. It sometimes would not dilate the stomach sufficiently, and at other times from the suddenness of the inflation there would be acute symptoms of pain. In half of the cases the stomach was found to be in a different position from that which they had been led to suppose it occupied, owing to insufficient dilation or premature leakage of the gas into the intestine. He thought the majority of men working upon this subject had been convinced of the unsatisfactoriness of the CO₂ method. He did not entirely agree with Dr. Behrend in regard to the objections to the stomach tube. It had been his experience that private and hospital patients did not object very greatly to its use. After being once used his experience was that it made a good impression upon the patient. From the routine habit observed in the University Hospital of inflating every stomach washed out, it had been found that many more people than were supposed were suffering from ptosis of the stomach.

DR. BEHREND said in closing that in the cases in which it had been impossible to obtain dilation of the stomach there was the possibility that the powders were not exactly fresh. His experience had been that patients do object to the stomach tube.

Report of a Case of Gunshot Wound of the Thorax Involving the Heart.

By L. J. HAMMOND, M. D.

[Read May 28.]

On March 26 of the present year, J. F., a laborer, 51 years of age, and a Pole by birth, was brought to the hospital by a patrol, 7 1-2 hours after having received a gunshot wound of the thorax, which was said to have been received accidentally.

I saw the patient about one hour after his admission, at which time he was satisfactorily recovering from shock, temperature being 98, pulse 96, respirations 30. Objectively the man showed nothing remarkable so far as expression was concerned, excepting some pallor about the lips and some

blanching of the conjunctival surface. He was able to answer such questions as he could be made to understand; the inability, however, to speak his language, as well as the marked defect in his hearing, made anything like a satisfactory history from him impossible.

Inspection at this time showed the wound of entrance of the bullet to be about one and one-half inches above the ensiform cartilage, and about the same number of inches to the left of the sternum. The bullet had evidently glanced before penetrating the thorax, as shown by the burned condition of the tissues for fully one-quarter of an inch. There was an immense hematoma extending from the posterior axillary line to the nipple line, and from the axilla above to the diaphragm below. Fluid was distinctly felt in the soft tissues external to the ribs.

The patient was reacting so favorably to the usual methods employed in the treatment of shock that there seemed no reason for alarm on account of hemorrhage after the lapse of this number of hours. The treatment consequently consisted in placing the patient absolutely at rest in the recumbent position, first having rendered the entire thorax perfectly aseptic, dressing the wound with aseptic dressing and strapping the entire side with broad adhesive strips to favor absorption of the hematoma.

From this time on until the afternoon of April 1, six days after admission, the patient's temperature and pulse ran practically a normal course. On the afternoon of the sixth day, temperature rose to 102°, pulse to 102, subsiding, however, at midnight of the same day. From this period until the sixth of the month, eleventh day after receiving the wound, there were no untoward symptoms. At this time temperature ran to 102°, pulse to 102. On the seventh, temperature had again dropped to normal, pulse to 100, respirations 24. On the morning of the eighth, the fourteenth day, temperature again rose to 102°, pulse 92, respirations 20.

At no time after the day of admission were respirations above 24. Urine was voided normally and bowels acted regularly. Only once does the chart show the necessity for administering an enema.

About 7 P. M. on the fourteenth, when apparently in the very best condition, indeed unwillingly retaining his bed, the patient was attacked with vomiting, and died almost instantly.

There were not, from the time of the patient's recovery from shock until his death, any of the cardinal symptoms of wound of the heart present, such as prostration of strength with swooning or syncope, thready or weak and irregular pulse, precordial distress and anxiety nor dyspnea, and in the absence of these, earlier liberty was given, both as to moving about in bed, also to diet, than would have been allowed had these symptoms been present to have warned of the nature of the injury. There is much reason for the belief that had the cause of this intercurrent attack of vomiting been averted, the patient would have entirely recovered the injury to his heart.

AUTOPSY.—The autopsy was made by the Coroner's physician. The bullet, a 32-caliber, had entered the thorax at a point 1 1-2 to 2 inches above the ensiform cartilage and 1 1-2 inches to the left of the sternum, fracturing the rib at that point, passing through the pericardium and through the apex

of the heart, making a wound about one-quarter of an inch in depth. It then passed through the pleura and gained exit from the thorax between the sixth and seventh intercostal spaces, being found in the subcutaneous tissues, after having passed through all the deeper tissues of the back. Its presence could not be detected on palpation because of the presence of the immense hematoma, and later because of its being imbedded in organized blood clot. The entire heart muscle was enveloped within a well organized blood-clot, and about a gallon of serum and blood was removed from the pericardium and the left pleura. All the other organs were apparently normal.

A search of the literature shows a number of cases of bullet wound of the heart in which complete recovery has taken place, and also instances in which, owing to entire absence of symptoms that would cause suspicion of involvement of the heart, death has occurred that might have been averted.

George Fischer,¹ in his collective report of 452 cases of heart wound, records 380 deaths and seventy-two recoveries. Death was immediate in 104. In 270 it occurred after intervals varying from one hour to nine months. Of this number seventy-two were gunshot wounds; with twelve recoveries; autopsies on several of the cases that had recovered, they having died from other diseases, verified diagnosis made long after the original injury. This circumstance affords good ground for supposing that the others were correctly diagnosed.

P. S. Connor² reports a case of gunshot wound of the heart wherein both ventricles and the right auricle were involved, yet the patient lived three years, two months and thirteen days.

Steudener³ reports a case of pistol shot wound of the heart with survival for fifteen weeks. In this case autopsy showed a cicatrix at the apex of the left ventricle corresponding to the wound in the pericardium, grains of powder also being found imbedded in the substance of the heart.

James Fayrer⁴ mentions a case of bullet wound of the heart, in which the patient survived seventy-two days. The bullet was found in the apex near the left ventricle.

Tillaux⁵ exhibited at the *Société de Chirurgie*, the heart of a woman who had survived two gunshot wounds for eighteen days, one of the missiles lodging in the left ventricle.

H. W. Boone⁶ reports a case of gunshot wound with survival for thirteen days.

Richard J. Booth⁷ reports the case of a woman who died twenty minutes after admission to the Kimberly Hospital, South Africa, suffering from penetrating wound of the pericardium and left ventricle.

James Berry⁸ reports a case of bullet wound of the heart in which

the bullet passed through the cavity of the right ventricle and inter-ventricular septum, emerging close to the inferior vena cava, patient surviving one hour.

B. Beer⁹ reports a case of an old soldier who was wounded in 1861 by a small rifle ball, which entered the thorax from behind, on the left side between the second and third ribs. It was found imbedded in the heart wall near the left ventricle, thirty-seven years later, the patient having succumbed to carcinoma of the arm.

G. P. Biggs¹⁰ reports a gunshot wound of the heart in which patient survived three days. The bullet entered the thorax inside the left nipple line.

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Exhibition of Two Vermiform Appendices Removed at Operation.

BY L. J. HAMMOND, M. D.

[Exhibited June 25.]

The specimens represented two stages of appendicitis frequently observed. One was necrotic and was found in a large pus cavity, accompanied by a concretion fully the size of a date seed, entirely free from its cecal attachment. The other represented the acute condition with a gangrenous area, and adhesions to it of the mesoappendix and a considerable patch of the mesentery by the exudate that had taken place in 40 hours.

SYMPOSIUM ON CLUB FOOT.

[June 25.]

Flat Foot or Acquired Valgus.

BY JAMES K. YOUNG, M. D.

The diagnosis of flat foot can usually be made by inspection, but more scientific means should be employed to render the diagnosis more accurate, and for purposes of record. A determination of the

angle of inclination of the foot and the pressure outline of the foot are most important facts to be determined in arriving at an estimation of the degrees of deformity.

The outline of tracings are best obtained after the method of Rohmer¹ and Roberts.² The plantar surface of the foot is coated with some material and an impression is made upon prepared paper in such a way as to render it permanent. Many different materials have been employed for this purpose, and I have for many years used vaseline. The most satisfactory method for preservation is that indicated by Freiburg,³ by which an impression is made with an alcoholic solution of tincture of iron and fixed with a solution of tannic acid.

In order to determine the angle of inclination I have selected the mediotarsal joint as the base line of measurement. This I have determined by marking a point on the foot half an inch behind the scaphoid tubercle on the inner side of the foot, and one inch behind the tubercle of the fifth metatarsal bone on the outer side of the foot. A third point should be marked on the foot between the two sesamoid bones at the head of the first metatarsal bone by means of a crayon pencil. When the impression is made on the paper this crayon point will appear in front of the two points on either side of the foot which should be marked on the paper before the tracing is made. These side points are connected and indicate the mediotarsal joint. A perpendicular is erected upon this corresponding to the long axis of the os calcis, the angle of inclination is obtained by drawing an imaginary line from the junction of these two lines through the head of the first metatarsal bone.

From numerous measurements made upon patients suffering from different deformities of the feet, it was found (Roberts) that the average in males was thirty-four degrees plus, and in females thirty-one degrees plus. In flat foot the angle may be reduced as low as five degrees, the average being eight degrees plus. In varus the angle of inclination may amount to over sixty degrees, and Roberts considers all internal deviations in excess of forty degrees as normal. Thus, it will be seen that in flat foot we have an angle amounting from five degrees to twenty degrees; in the normal foot the angle is from twenty degrees to forty degrees, and in club foot the angle of deviation is from forty degrees to sixty degrees.

Another important means of diagnosis is the inclined mirror

¹ *Les Variations de Forme Normales*. Nancy, 1879.

² *Medical News*, March 20, 1886.

³ *Boston Medical and Surgical Journal*. November 8, 1900.

which permits the surgeon to inspect the impression made by the foot upon a plate of glass. This may also be used to make tracings, the outline being traced in the glass by an aniline pencil and transferred directly to a sheet of paper. In a recent case a diagnosis could not have been made but for the use of the inclined mirror, the impression of the foot on the glass displayed an increased pressure of the base of the second, third and fourth metatarsal bones.

DIFFERENTIAL DIAGNOSIS.

The differential diagnosis of flat foot should be made from (1) pronation; (2) breaking down of the anterior arch, and (3) rheumatism. Osteitis may be present as a cause or effect, but its differential diagnosis is not difficult.

1. *Pronation* of the foot as understood to-day is the weak ankles of yesterday. The pressure of the body-weight upon the foot causes the inclination of the ankle inward. This may be more accurately determined by composite photography. By taking several photographs upon the same plate with the weight off and on the foot the amount of pronation of the inner malleolus, as well as its movement inward, can readily be indicated.

2. *Breaking down of the anterior arch* produces a wider foot with frequently the formation of callus in the anterior part of the sole. This is best determined by the inclined mirror, and as its treatment is entirely different from flat foot it should receive more attention than has been accorded to it.

3. *Rheumatism*.—There is no affection so frequently confounded with flat foot as rheumatism. Flat foot frequently follows upon the relaxation caused by rheumatism, but flat foot from many other causes is frequently confounded with rheumatism on account of its intermittent character, and the presence of inflammatory symptoms.

Rheumatism of the feet may be distinguished by the presence of rheumatism in other parts of the body, and by careful investigation of the clinical symptoms which accompany that affection and which exhibits itself in many ways.

TREATMENT.

The treatment of flat foot should be modified to meet the three different degrees: (1) mild; (2) medium; (3) severe.

1. *In the mild form* the restoration of the arch may be accomplished by the use of a pad of gauze held in place by adhesive plaster and by a bandage. For permanent use this pad should be substituted

by a plate which may be made of different materials, steel, phosphor-bronze, aluminum, German silver and many other materials have been used. A steel spring coated with hard rubber has been used by the writer for a number of years, and of late has been replaced by rubber and celluloid plates. In adults it will be necessary to use a metal plate of some kind protected from perspiration by impervious materials. The shoe may be especially made, and a hard leather sole may be built into the shoe.

The plates of whatever form will hold the foot in position while the arch is being restored by exercises and massage. The principle employed in the application of plates in the treatment of flat foot is founded upon the support of the astragalus. The relaxation of the ligaments, particularly the calcaneoscaphoid or spring ligament, permits the astragalus to fall downward, forward and inward, and the plates should be so constructed as to overcome this tendency, and this is why the writer always employs a flange on the inner side of the flat foot springs.

Exercises and massage form a most important part of the treatment. Special exercises are given consisting of special movements to develop the weaker muscles. These should be superintended by the surgeon in charge and should be modified in such a way as to correct the deformity fully.

Massage should always form a part of the treatment, and this would best be given immediately after the completion of the exercises.

2. *In the medium* degree of flat foot all the measures before described will have to be employed, and in addition forcible correction under ether has been found to be the most satisfactory method of treatment. At this time, if tenotomy of the tendo Achillis is found to be necessary it should be performed. After the forcible correction a suitable pad should be held in position in the sole of the foot by means of a plaster cast. This should be worn for two or three weeks, after which the treatment before described should be continued, with the addition of an ankle brace.

3. *In the severe* form operative measures should be employed to restore the foot to a normal condition. These include operative procedures on the muscles and skin intended to shorten the arch of the foot by cicatricial contraction and shortening or elongation of the tendons, as is necessary. The removal of the astragalus has been performed in most severe cases, but only in the most exceptional cases would this become necessary.

Pes Equinovarus.

BY GWILYM G. DAVIS, M. D.

The name club foot when used in a general sense is often applied to several different varieties of deformity of the feet such as varus, valgus, cavus, equinus, etc. In its more restricted sense it is used to designate the special form in which the foot is turned inward, pes varus, and in which oftentimes the heel is elevated constituting equinovarus. Many of the deformities of the feet are acquired, being the result of paralyses, injuries, diseases such as rheumatism and other causes.

Equinovarus, while sometimes acquired, is usually a congenital affection, and exists in a more or less marked condition from birth. As a rule, there is no difficulty in diagnosing it. The foot is turned inward, usually both are affected, pointing toward each other instead of forward. It is so marked that the mother will notice it and bring it to the attention of the physician. Therefore, this affection, like so many others, first comes to the notice of the family practitioner and to him belongs the responsibility of advising as to its treatment. There are some deformities, such as bowlegs in rachitic children, which seem at times to improve and diminish as the child grows. Hence radical measures of treatment in such cases can often be deferred or avoided. This being so has apparently led some to advise deferring treatment in cases of club foot.

Patients are continually applying for treatment who have reached the age of several months without any serious effort having been made to correct the deformity.

Equinovarus is not like the rachitic diseases of the long bones; it does not tend to improve. On the contrary, it tends to become aggravated and more marked. A foot readily straightened by manual pressure soon after birth becomes set in its distorted position. The contracted muscles become shortened and the bones deformed in shape and hardened, thus preventing reposition. Such being the case it is evident that the earlier treatment is undertaken the easier may the deformity be corrected; therefore, attention should be given to the deformity almost from the time of birth.

The question suggests itself as to what is the duty of the practitioner in these cases? Deformities in children are only to be corrected by long continued, intelligent and persistent treatment. Equinovarus in its earliest stages can be quite successfully handled by the physician if he is fairly well informed and occasionally consults a

specialist to be sure that the treatment is progressing satisfactorily. There are some cases, it is true, that are so severe and obstinate as to tax the resources of even the most skillful, but the majority of them can have the greater part of the treatment intrusted to the family physician, provided he is willing, and all are not, to give it the attention it requires. If a child, soon after birth, is discovered to have club foot, the first thing to do is to have judgment passed on the degree of severity of the deformity and to outline a plan of treatment. The mother should not be told to wait until the child is older, unless it is expected to die soon, neither should she be referred to the surgical-instrument maker. If the physician himself does not feel capable of advising at once as to treatment then he should consult a specialist who will outline a plan of treatment for him to carry out.

The character of the treatment will vary according to the age and condition of the child and the severity of the deformity.

The age and condition go hand in hand. If the child is in good physical condition active treatment can be instituted at once no matter what its age, it cannot be too young. If, however, it is so weak and sickly as to be likely soon to die then it is obviously unwise to worry and distress it with attempts to correct a deformity that will not manifest its disabilities until the child begins to walk.

There are three different stages in the treatment of a case of moderate severity.

The first stage is of manual correction; the second is that in which bandages, splints and other simple appliances are used, and the third is that in which apparatus made by the instrument maker is worn. In the last two stages the question of tenotomy may arise.

The first stage, that of manual correction, may usually be instituted as soon as the patient is seen. It consists in straightening the foot by the hands so as to bring it as near as possible to its normal position and to stretch or compress the resisting structures. The mother or nurse should be taught and shown by the physician how this is to be done.

The leg is grasped low down, around the ankle, with one hand while the foot is first turned out in a line with the leg, with the other hand, and then flexed on the leg so as to stretch the tendo Achillis. Sometimes a considerable degree of force is necessary in this manipulation and usually the child cries.

This stretching is to be done by the mother or nurse at least twice a day, and perhaps oftener. If the child is weak and sickly the stretching should be mild, if it is strong and hearty a proportionate amount of force may be exerted. If the leg is firmly grasped around the ankle no harm will ensue.

This stretching should really be continued until the case is cured though oftentimes the parents get tired and cease it. After a few days or weeks the next step may be instituted. This consists in applying a bandage and splint. The bandage is a two-inch, white flannel one and the splint a plain gutter made of strong sheet iron or tin. While one person holds the foot as nearly as possible in a corrected position another applies the bandage from the toes to the knee. In applying the bandage it should be carried under the sole of the foot from the inside to the outside so that it draws the foot outward. The bandage having been applied the foot is laid in the splint at right angles to the leg, care being taken to see that the heel is as well down in the splint as possible. Sometimes, owing to carelessness or inefficiency, if the case does not seem to be progressing satisfactorily, the plan of stretching and fixing in plaster-of-Paris may be tried. It is a very effective method and severe cases can be unfolded by its persistent employment. In using it the foot is first thoroughly stretched with the hand. It is then to be bandaged with a white flannel roller, the foot being held in as well corrected position as possible. Several thicknesses of bandage are used to serve as padding. A plaster-of-Paris bandage is next applied and when completed the foot is firmly stretched into as good a position as possible and held there until the plaster has hardened. Thus the foot is retained in place. This bandage is left on for a week and then removed, the foot bathed and another stretching given and new bandage applied. Thus the foot by the repeated stretching and bandages is gradually turned outward and the deformity overcome. The use of the plaster bandage in extremely young children is not satisfactory sometimes on account of the difficulty of securely holding the foot, so that splints reapplied once or twice a day are usually preferable. The application of the splints or plaster bandages or both are continued for perhaps several months, at least until the foot with a moderate degree of force can be turned out in line with the leg and then flexed at right angles to it. The child may be six months or more old by this time, according to the age at which treatment was begun. Especial effort should be made to straighten the foot sufficiently to allow the use of a brace by the time the child attempts to stand on its feet and walk. When this time arrives, or even sooner, if the foot is ready, a club foot shoe, made by the instrument maker, may be substituted. A club foot shoe may be perfectly simple, it need have no screw movements. It consists of a shoe, opening clear to the end of the toes, fastened to side irons that go above the knee, with joints at the ankle and knee. A rubber band passes from the shoe to the side iron. The shoe is made open to allow the foot being firmly pressed into it, a strap is fastened over the instep

which serves to hold the foot in the shoe while it is being laced. The elastic strap is then buttoned to the side iron and serves to exert a steady slight tension on the tendo Achillis. If this strap is too tight, pain will be caused and the foot will turn in the shoe.

The side irons are carried above the knee because experience has shown that they prevent rotation and are thereby rendered more efficient. If, on using the brace, it is found impossible to keep the heel down in the shoe then the brace should be discontinued and the child put through a few weeks' course of stretching and plaster-of-Paris as already described.

This treatment will suffice for cases of moderate severity. When obstinate cases are encountered in which it is difficult to bring the foot in line with the leg and impossible to bring the heel down, then tenotomy of the tendo Achillis, often with division of the plantar fascia, is the first operative measure to be employed. This may with propriety be resorted to in exceptional cases in quite young infants. In rare cases tenotomy of the anterior and posterior tibial tendons may be done.

Cases of club foot apply for treatment at all ages and the older the patient the harder the bones, which may by this time have become distorted, and the more severe are the measures necessary to obtain satisfactory results. It is usually above the age of six years that it is necessary to resort to these operations but occasionally younger children, sometimes as young as two years, may have feet so resistant and distorted that to rely on stretching and plaster-of-Paris, even though aided by tenotomy, would entail too much care on the part of the parents and too much suffering on the part of the child.

If tenotomy has once been done, a second division of the same tendons will rarely cause the foot to yield much, so that they should only be divided in those cases in which we feel sure that no further operative measures will be required. The more severe operative measures consist either in dividing the contracted tissues on the inside of the sole of the foot, as advocated by A. M. Phelps, a simple osteotomy of the astragalus or even clear across the tarsus, or the removal of the astragalus or a wedge-shaped piece of the tarsus, irrespective of the joints. Of these, the wedge-shaped resection is my choice and my belief is that the others are but rarely desirable.

A simple osteotomy across the tarsus does not allow of sufficient mobility and can only produce a satisfactory position of the foot if the deformity is not severe. Such cases can be cured by tenotomies and stretching, with the subsequent application of plaster-of-Paris.

The foot is composed of two longitudinal arches; they unite posteriorly in the calcaneum, but anteriorly the inner one embraces

the astragalus, the scaphoid, the three cuneiform bones and the inner three metatarsals. The outer arch is continued forward in the cuboid and the outer two metatarsal bones. In marked cases, and it is only in such that these operations are to be done, the bones are distinctly deformed. The operation of Phelps does not involve the bones, but only the soft tissues of the foot, hence the deformed bony arches remain more or less in their distorted positions and tend to perpetuate the deformity and favor a relapse.

Astragalectomy removes one bone from the inner arch but does not disturb the outer arch, but it allows the foot, as a whole, to be turned outward. Therefore, we find it leaves the patient with a foot nearly as much deformed as ever, only tilted more outward. The bending inward of the forward part of the foot persists and while fairly satisfactory results can be obtained in a few cases, the relief both from the deformity and disability is only partial. I have operated a second time on such a case, and I have just seen a patient who is to return later for a second operation. The removal of a wedge of bone, while not by any means ideal, enables us to make the best possible correction. As done by myself, it consists in making a straight incision over the projecting hump, in front and to the outer side of the ankle, extending from the tendon of the little toe, in front, to the peronei tendons, behind. The peroneus tertius tendon, if seen, may be pulled forward and the peroneus longus and the peroneus brevis pushed backward. No tendons need be cut and through this incision sufficient bone can be removed by the chisel and gouge, clear across the tarsus, to enable the foot to be brought absolutely straight without much tension. In rare cases it may be desirable to divide the tendo Achillis. The elastic tube or tourniquet is used to prevent hemorrhage during the operation and the foot is placed in plaster, the wound being closed with two or three sutures without drainage. The subsequent use of braces is usually unnecessary.

The causes of failure in the treatment of club foot are lack of knowledge, both on the part of the surgeon and of the parent or nurse, and carelessness. Eternal vigilance is the price of good results and these cases demand so long continued attention that the parents allow the braces to become worn out and inefficient or they fail to attend properly to the stretching and bandaging.

The better attention these patients receive the fewer operative procedures will it be found necessary to resort to.

Sometimes the parents, at other times the doctors, are too timid and afraid to stretch the foot sufficiently and do not make it a point to see that they are doing at least enough to accomplish their object. If the general practitioner took a little more interest in these cases

when he first saw them, oftentimes at or soon after birth, and consulted a specialist as to the course to be followed in each particular patient, and if the specialist at such times would render to the practitioner such counsel and aid as would serve him at least for a time, then we would have these cases treated while they were in a condition to respond to mild measures and we would see fewer old, distorted, hardened and crippled feet.

On the Treatment of Talipes Equinovarus.

BY J. P. MANN, M. D.

A few preliminary considerations bearing on the subject under discussion will, perhaps, lead to a clearer conception of the views expressed in this paper. Talipes equinovarus, a deformity in which the heel is permanently elevated and the foot turns inward, may be either congenital or acquired. Of all malpositions of the foot it is, by far, the most common, occurring in three-fourths of all congenital club feet and in one-third of the cases in which the condition is acquired. All statistics agree that congenital talipes equinovarus is seen more frequently in the male than in the female and that one foot is affected nearly as often as both. On the other hand, in the acquired form unilateral involvement is more often encountered. Whether the abnormality occurs before or subsequent to birth, the right foot is more frequently deformed.

All parts of the foot participate in the deformity and in many instances the entire limb, especially at the knee and hip joints, is markedly changed from the normal.

Positional and relational changes are quite noticeable in the astragalus, os calcis and scaphoid bones. The ligaments between the scaphoid, os calcis and internal malleolus, all structurally changed, are exceedingly resistant tissues. The tibialis anticus and posticus, the gastrocnemius and soleus are the muscles which are most active in retaining and increasing the deformity. Many cases, seen early enough, readily yield to corrective measures, but it should be borne in mind that with increasing age the parts become less tractable.

Classing manual correction as mechanical, the treatment of talipes equinovarus is: (1) *Mechanical*; (2) *operative* or (3) *by a combination of the two*.

Mechanical devices are both multitudinous and multiform, and many of them are of very doubtful value, hence those only which have seemed to prove efficient will be mentioned in this purposely brief and general study of the subject before the society.

Manual correction, always tedious, is applicable during the first four or six weeks after birth. Now and again a faithful parent or nurse will remedy the deviation by the hand, but this method is not to be depended upon except in a limited number of cases.

Manual correction, the elastic band and adhesive or other strips, all agents used to restore the foot to its normal position, serve best as adjuncts to other more certain plans of treatment.

Treatment by the plaster bandage or by some form of simple splint is far more efficient than any of the above mentioned measures. Whether one employs a plaster bandage or a metal splint the same principle applies. The surgeon, by a weekly re-application of the plaster bandage or by frequently bending the splint, aims to gradually force the foot into proper position.

If the plaster bandage method of adjusting the deformity is preferred the foot should be well covered with absorbent lint or cotton to protect it from the rough plaster. Constriction of the foot sufficient to stop its blood current, will cause gangrene within a day or two and undue pressure of the plaster dressing over bony prominences produces ulceration quite quickly. The toes should never be covered by the plaster dressing, since their exposure affords constant opportunity for ascertaining the condition of the circulation. If the plaster case be too tightly applied a linear incision extending through its entire length will allow the foot more room. Should there be undue local pressure a trap door cut in the plaster splint over the point of irritation secures speedy relief. Treatment by the plaster splint, in careful hands, will not lead to atrophy; on the contrary, the treated foot will be distinctly larger than its neglected and deformed fellow. This method has no insuperable difficulties, and is entirely worthy of a trial in a large majority of instances. It can be used prior to the institution of operative measures and will always help if it does not secure complete restoration.

Correction of talipes equinovarus by a simple metal splint, which is ordinarily attached to a suitable shoe, is a very effective and widely recognized method. Intelligently and persistently applied it assures a fairly speedy relief in many cases. If limited to a choice of one of the last two plans of treatment, the simple metal splint would be selected, because it can be readily conformed to the foot, daily if necessary, and can be used for months or years, allowing the subject to walk at will and with freedom of motion. The plaster bandage

plan is usually employed for a few weeks or months. Both of these corrective plans are employed as retainers in the postoperative treatment of the deformity; the plaster bandage being applied during the four weeks just subsequent to operation. When the plaster case is removed a suitable metal brace and a shoe are used to maintain the normal position of the foot. Complicated metal braces are mentioned only to be condemned. The patients and their parents cannot properly handle them and frequently they are too much for the surgeon.

From an operative standpoint the procedures to be considered are: (1) tenotomy; (2) division of ligaments and fasciæ; (3) open incision or Phelps' operation; (4) bone operations and (5) *brisement forcé* or the use of extreme force.

Correction by tenotomy needs little discussion. Limited to those cases in which there is little or no involvement of the other foot structures, it will prove efficient and if followed by suitable aftertreatment a permanent reposition is the usual result.

Where fasciæ and ligaments are greatly involved in the deformity, they must be stretched, torn or divided by the knife and it will also be necessary to resort to tenotomy in this class of cases.

Phelps' operation or open incision consists in a division of the resistant parts through a transverse opening on the inner border of the foot near the tarsometatarsal articulations. This operation is combined with sufficient mechanical force to overcorrect the deformity. The foot is now dressed, a plaster bandage is applied and elevation maintained. The large open wound closes by granulation in from one to three months.

The gaping, granulating wound left by this operation invites sepsis and unnecessarily mutilates the foot. The writer has not infrequently observed the occurrence of infection in open operations, and in order to relieve pain and to control the septic process it was necessary to remove all restraining apparatus. The usual result in such instances was the return of the foot to a position less useful, more deformed and less operable than before. These and other reasons strongly point to the avoidance of Phelps' operation.

Osteotomy of the astragalus, astragalectomy, cuneiform osteotomy and other bone operations are resorted to in the correction of talipes equinovarus.

Krauss, Wolff, Bradford, Lovett, Lewis, Reginald Sayre, Lorenz, Young, Allis and many other authorities affirm that the deformity can be corrected by section of the nonosseous tissues aided by force and retentive appliances. This is a strong statement, whose accuracy has been amply attested.

Quoting from H. A. Wilson's paper on "Bone Operations for the Correction of Club Foot,"¹ Shaffer, replying to Dr. Wilson's question: "How many bone operations have you performed for the cure of club foot?" says: "If your query were: How many cases have you had which have been condemned to osteotomy and which you have cured without operation? I could give you some statistics." Lorenz says: "I consider every bone operation in club foot as a mutilation of the foot and as a criminal act to the practice." Wilson remarks in his paper that: "A very large majority, if not all could be corrected by soft structure section, either with manual or mechanical stretching and tearing," with adequate postoperative treatment.

Willard says: "My typical results are in those cases corrected without the removal of bone" and "I find it unnecessary to remove any bone except in cases where the dislocated head of the astragalus is too large to be returned to its normal position." "The dimensions of the bone are readily determined by the X-rays."

James K. Young says: "I regret that I have no bone operations to report." Thus it appears that leading orthopedic surgeons if at all possible avoid bone operations for the rectification of talipes equinovarus.

The writer has never found it necessary to resort to operation on the bone for the correction of club foot.

Through *brisement forcé*, which is the application of manual or mechanical means of treatment either separately or combined, one can, in many cases, more or less gradually compel the foot to assume a normal position. It is a very efficient plan of treatment, but is generally supplementary to operative methods.

Open tenotomies, open section and bone operations have seemed entirely unnecessary in the more than seven hundred deformed feet that have come under the writer's care.

Subcutaneous division of the involved soft tissues, aided by stretching and tearing, has proved entirely adequate to the correction of the most resistant feet. Open operations will correct deformities, but subcutaneous division will produce the same result with less risk of sepsis, less mutilation of the foot, less pain to the patient, without any exposed cicatrices and with greatly decreased postoperative contraction; thus insuring a stronger, more shapely and more useful foot than can be obtained by open operation.

Sepsis is almost unknown to the careful subcutaneous operator. The author never had a case. The careless surgeon is incompetent to operate on club foot or anything else. When sepsis appears in subcutaneous work it is just as readily opened and cleansed as is an open

¹ Reprint from the Transactions of the American Orthopedic Association, September, 1893.

section, which, owing to infection, must be reopened after having been sutured. Does not every single wound that is thus sutured become, in reality, a subcutaneous operation?

It is not difficult to identify subcutaneous structures requiring division. Important nerves or vessels are easily avoided, and such operations consume much less time than open work and at the same time they shorten postoperative treatment. It is needless to say that where one desires to shorten a tendon open operation must be performed.

Following operation, fixation of the foot in an overcorrected position should be maintained by plaster bandages applied from the toes to just above the knee joint. The foot is thus moulded and forced into the required position. The bones and soft tissues will all yield to the continuous pressure of the rigid dressing.

The plaster bandage should be removed weekly for inspection of the foot and neglect of this precaution may result in serious pressure injury. When changing the plaster case, if the correction is unsatisfactory, opportunity is afforded for anaesthetising the patient and using leverage for further correction. This will often be essential to reposition in severe cases.

Subsequent to treatment by fixed dressings a retaining shoe and brace must be worn for varying lengths of time. In marked deformities of children these are worn until about the twelfth year when ossification is completed. In adults the time will vary with the degree of deformity.

After discarding apparatus, both children and adults should be kept under observation, and if there is any tendency to a relapse the supports should, at once, be reapplied.

Dr. Mann exhibited a patient, a boy of seventeen, on whom he had operated for talipes equinovarus. The operation was done by the subcutaneous method, dividing the tendons and fasciæ. The result was eminently satisfactory.

DISCUSSION.

DR. J. T. RUGH showed a small plate used in the correction of flat foot, devised by Gefvert, the simplicity of which appealed to him. In its use, there is but little interference with the normal functions of the foot as it occupies only the arch, and it is readily adjustable to any changes that occur in correction. Another advantage is its easy adjustment without a cast or remoulding. One objection to many braces is that the ankle joint is placed too low. The joint in the brace should be directly opposite the center of the joint to be supported. He believes that bone operations have a distinct place in the cor-

rection of flat foot. In some cases the bony changes are so great that a dislocated astragalus cannot be replaced between the two malleoli, but must be removed.

DR. JAMES K. YOUNG, in closing, said that, in his opinion, in cases requiring bone operations astragalectomy is more satisfactory than the removal of a wedge-shaped bone from the outer side of the foot. The skiagraph he considers the best means of determining the necessity for bone operations. He does not use the tourniquet except in Phelps' operations. He has performed the Phelps operation without having granulation tissue appear in the wound, but he has also seen cases in which it was present. He described the technique of the Schede operation; in this method a cicatrix is secured within 4 weeks without granulation and without subsequent dressings.

DR. G. G. DAVIS said that he regards the use of plates or some simple support very satisfactory in flat foot; hence, he will not use a patented plate. He thinks surgeons are agreed that while some cases of equinovarus can be corrected by nonoperative means others resist all such methods. Radical operation in comparatively young patients, he believes, is often better than the adoption of tentative and conservative measures, particularly cases in which the parents are negligent and in which the surgeon practically has to care for the patient himself and in cases sent to the surgeon from a distance for a short time only.

DR. J. P. MANN in closing stated that he had never seen the change of the platinum plate into a powder as mentioned by Dr. Young. A portion of the plate shown by Dr. Rugh is aluminum and Dr. Mann has used such instruments in elevating the arch of the foot for 10 years, and he has never seen them converted into powder. By covering the instrument with a thin leather sole he prevents the destruction of the plate. Dr. Mann endorses the correction plate exhibited by Dr. Rugh as the most satisfactory for flat foot that he has found, his only objection being that it is patented. The patient whom he exhibited was an extreme case and had remained in the hospital 5 months, the average stay being 6 weeks, while many leave within 3 weeks.

Cases of Carcinoma and Sarcoma Recently Treated by Electric Sterilization.

BY G. BETTON MASSEY, M. D.

[Read June 25.]

In a paper read before the American Electro-Therapeutic Association in September, 1900,¹ the writer reported a series of thirty-eight malignant tumors that had been placed under the cataphoric diffusion of electrolytic salts of mercury and zinc for destruction and sterilization with the following results: In eight cases a cure was

¹ Trans. Amer. Electro-Therapeutic Assoc., 1900-1901.

obtained; in twenty cases the local disease was removed, but the patient succumbed ultimately to metastases that were apparently existent at the time of the application; in eight cases the method, while still new, had failed to stay the progress of the local disease; and in two cases the patients had died during the treatment.

A review of these cases at the present time shows that one case reported as a cure, a recurrent carcinoma of the breast and axilla, has died from metastatic growths in the mediastinum without return of the local disease; the remaining seven successful cases have stood the test of two more years without redeveloping the disease.

Since the date of that paper fifteen additional cases have been treated by the writer up to April 1, 1902, each of which will be described in this paper in the order seen, the unsuccessful cases being but briefly epitomized to save space.

CASE XXXIX. Miss M., aged 37, of St. John, N. B., was first seen October 20, 1900, with a small growth above the right canine tooth. She was referred to Professor Cryer, of the University, for diagnosis, who reported the tumor to be carcinomatous.

Under repeated minor applications of zinc-mercury cataphoresis, with fine needles, the growth was destroyed in about 3 weeks. There has been no return of the tumor.

CASE XL. S. J. C., aged 60, was referred by Dr. C. A. Groff, of Philadelphia, January 22, 1901, with a recurrent carcinoma of the tongue and floor of the mouth. The tongue had been amputated by the knife operation but 7 weeks before. This early return, and the extensive and deep infiltration that had so quickly reappeared rendered all effort apparently hopeless, yet, to give him a last chance, he was admitted to a private room at the Presbyterian Hospital and a major application made to the affected parts, under general anesthesia, 350 to 500 milliamperes being employed for 2 1-4 hours. This resulted in considerable destruction of the diseased structures, but not complete sterilization. The growth reappearing later, he was referred to Dr. Edward Martin, who removed the tissues of one side of the jaw and neck down to the larynx, with only temporary benefit, the patient shortly succumbing to the disease.

CASE XLI. Mrs. —, aged 53, was first seen March 5, 1901. At this time there was an irregular growth beneath and involving the right ear that was about the size of a split cocoanut, but irregular in shape. (Fig. 1.) The lower half of the ear was fused in the growth, which extended forward on the cheek and downward between the jaw and the neck to the angle of the lower jaw. The skin did not seem to be involved, though ulcerated through at one spot, but the immovable base showed a deep infiltration into the structures of the neck. Owing to the patient's unwillingness no photograph was taken.

The history of the growth showed an existence of 19 years, including recurrences after two extirpations with the knife and one caustic applica-

tion. The first cutting operation was performed by the late Dr. Agnew, in 1884. The second operation of the same character was done, in 1891, by a well-known surgeon, assisted by Dr. Agnew; in this operation the seventh nerve was severed, resulting in paralysis of the right side of the face.

Realizing that I had to deal with a malignant growth of slow progression, and not prone to metastasis, and also with a patient unwilling to again take ether, I decided to try the effect of the minor method of zinc-mercury cataphoresis, employing zinc needles amalgamated with mercury and thrust into the growth under cocaine diffusion. Small currents were



FIG. 1. Case XLI before treatment, sketched from description.

therefore applied daily in this manner for 30 minutes at a time. This treatment has continued over a year, with some interruptions, and is even yet applied once a week through the tiny openings in the skin where the growth was, but the case is now practically cured, a depressed cicatrix with soft edges occupying the site of the extensive tumor. (Fig. 2.) I shall keep these openings patulous for a time yet, and continue occasional applications to make sure that the last germ of the affection has been destroyed.

During the course of the treatment a piece of the tumor was removed and sent to the Philadelphia Clinical Laboratory, which gave a histological diagnosis of carcinoma.

CASE XLII. Mrs. L., aged 63, was first seen in March, 1901, with a large cancerous ulceration occupying the site of the right breast, the growth measuring 11 by 7 inches and extending down to the intercostal

spaces. The outer edge of the infiltrated border extended well up into the axilla, but, though the apex of this space was infiltrated and the arm swollen, no glandular nodes were found.

This growth was evidently one of the slower-growing class in spite of its great extent, for it had been an open ulceration for more than 3 years, and had been first noticed 9 years before. The patient's general health was profoundly affected, as indicated by the photograph (Fig. 3), she was confined to her room, pallid and apparently cachectic. The absence of glandular infection and its long duration was, however, taken as an excuse to give her the chance offered by a major application.



FIG. 2. Case XLI after treatment.

On April 2, 1901, assisted by Dr. Hermance, she was etherized and the zinc and gold-mercury cataphoresis applied by means of 600 to 700 milliamperes for 2 1-4 hours.

The patient was so weakened by the disease that she did not recuperate from the prolonged anesthesia for several weeks. Her condition was, however, so improved by June 15, that it was decided to attempt further treatment by daily applications of as much as she could bear, applied to the extensive areas of still profoundly diseased structure that could not be reached in the first operation. From 50 to 150 milliamperes were therefore applied with sharp zinc-mercury points during the remainder of June and the whole of July. By August 5, the minor applications having become too painful, a second major application was made under ether, assisted by Dr. Hermance and by Dr. F. G. Du Bose, of Selma, Ala. Eight hundred milliamperes were applied this time for one hour and 35 minutes,

followed by quick recovery. By November the patient was well enough to make a journey to Brooklyn. In January, 1902, it was, however, seen that an edge remained still diseased between the shoulder joint and the clavicle. (Fig. 4.) A third application was therefore made January 28, 1902, requiring 500 milliamperes for 2 hours. The patient is now apparently well in every respect, though the large surface that was denuded by the disease has yet a smaller spot uncatrized than shown in the final photograph (Fig. 5).

A piece of this growth was removed at the first operation and submitted to microscopical examination at the University Pathological Laboratory, which reported as follows: "The specimen consists of large nests



FIG. 3. Case XLII after first application.

of epithelial cells contained within a delicate stroma of fibrous tissue. Cells present an epithelial appearance and completely fill alveolar space. Surface of the tumor is necrotic and invaded by leukocytes. Diagnosis: medullary carcinoma simplex of breast."

CASE XLIII. Mr. C. A. W., aged 47, was brought to me by Dr. J. T. Rimer, of Clarion, Pa., May 11, 1901, with a large recurrent sarcoma in the left groin and enlarged glands in the right groin. The primary growth had been a sarcoma of the left testicle, which had been removed August 7, 1900, the extension to the groin being noticed three months after the operation. The Coley serum had been thoroughly tried in this case, and resulted in apparently holding it in check and improving the general health for about 6 months.

When seen by me the growth measured 8 by 5 inches in superficial diameters and lay directly over the femoral artery, the compression of the femoral vein being evidenced by great tumefaction of the thigh. The diseased glands on the opposite side had the same dangerous situation. It was decided to try the cataphoric method, and on May 12 he was placed under ether and from 800 to 1400 milliamperes employed for 3 hours. The next morning I found him sitting up in bed reading a paper in spite of this prolonged anesthesia and powerful current. The edema of the leg had subsided.



FIG. 4. Case XLII after second application.

On the separation of the eschar it was, however, noted that some diseased tissue remained in the bottom of the cavity, and as the tumor in the right groin had not been reached at the first application, he was placed under a second, one month after the first. At this time 1400 milliamperes were again employed for 3 hours. He reacted well from this operation also, but unfortunately a secondary hemorrhage appeared in the site of the smaller growth, causing death on the fifth day.

CASE XLIV. Mrs. J., aged 36, was brought to me August 5, 1901, by Dr. F. G. Du Bose, of Selma, Ala., with a very extensive recurrent carcinoma of the right breast, the primary growth having been removed by the Halstead operation 8 months before. The whole right side of the

chest was infiltrated, producing cancer *en cuirasse*, and the arm swollen to twice its dimensions. In spite of the patient being almost *in extremis*, it was decided to attempt palliation of the extreme pain, causing her to consume 9 grains of morphine *per diem* without relief. Twelve hundred milliamperes were employed to diffuse the mercury and zinc salts for 3 hours. This resulted in such relief of pain that the morphine was shortly reduced to less than one grain *per diem*. Her general condition continued to improve until the end of the third week when sudden prostration occurred resulting in death, apparently from heart clot.



FIG. 5. Case XLII after third application.

CASE XLV. Mrs. X., aged 84, was referred by Dr. D. F. Woods, of Philadelphia, September 9, 1901, suffering from a primary carcinoma of the nose and a large secondary growth in the neck. As the left eye was about to be eroded by the primary growth it was decided to remove it by cataphoric sterilization, but not to attempt interference with the secondary growth in the neck because of the great age of the patient. A current of 200 to 300 milliamperes was accordingly employed with zinc-mercury points, the duration of the application being one hour. The disease was arrested in this situation.

CASE XLVI. The mother of a physician of Western Pennsylvania, aged 60, was first seen October 26, 1901, suffering from a recurrent carcinoma in the ischiorectal region. The original growth involved a portion

of the sphincter and had been removed by a Pittsburg surgeon 10 months before by a modified Kraske operation. When seen a sinus was found to the left of the anus with infiltrated and indurated edges, communicating with a cavity about 2 inches in depth, the whole growth being about the size of a lemon. The rectal mucous membrane was intact and apparently healthy.

At the application the cavity was filled with liquid mercury and into the mercury was inserted a gold tubular electrode, amalgamated, the two together constituting a mercuric electrode that accurately fitted the cavity in the center of the growth. From 400 to 650 milliamperes were maintained for one hour and 50 minutes.

During the passage of the current the induration melted down, the progress of the sterilization being determined by the increasing disappearance of the induration. The application was well borne, destroyed the odor of the discharge and relieved the pain. After the separation of the debris the cavity very nearly closed by granulations.

Her condition 6 weeks later was greatly improved, but it was at this time thought best to make another application as a part of the wound had not healed and was suspicious.

On December 15 she was, therefore, again anesthetized and the process repeated with 200 to 300 milliamperes. It was only necessary to keep up this application 40 minutes.

In a letter received from her son to-day he says: "I saw mother this morning and she is quite weak. I do not think there is any return of the growth, but there is some suppuration, which may have been caused by several small balls of mercury sloughing out. Her weak condition may be due to the fact that she has had influenza 3 or 4 times this spring."

CASE XLVII. Mrs. P., aged 65, was brought to me October 29, 1901, by her physician, Dr. Charles M. Dalsen, of Philadelphia, with a primary carcinoma of the right breast of 2 years' known duration. The growth had begun in the lower and outer quadrant of the breast, but at this time the whole organ was infected. The skin was adherent over the center of the growth and was about to break down. The growth extended well toward the axilla, but no glands were apparently affected in this situation. The patient was pale and in poor health, but, apparently, not deeply cachectic.

Under general anesthesia the major cataphoric application was made October 30, 600 to 700 milliamperes being used for 3 hours. Convalescence was uneventful, but revealed some disease still remaining near the axilla. A second application was therefore made March 9, 1902. The present condition is shown in the accompanying photograph (Fig. 6), revealing a small and healthy scar.

A piece of the tissue was removed just prior to the first application and sent to the Philadelphia Clinical Laboratory for histological examination. The report showed the characteristic grouping of the epithelial cells in "nests." Diagnosis: carcinoma.

CASE XLVIII. Mrs. S., aged 35, a patient sent by Dr. Anna M. Reynolds, of Philadelphia. Six months before the cervix uteri had been

amputated for carcinoma, the growth returning in a few weeks. The usual symptoms of inoperable carcinoma of the cervix were present, the pain being intense and the discharge fetid. Examination showed a deep excavation at the site of the cervix and extensive infiltration of broad ligaments. As the patient was comparatively young, it was decided to make an effort to arrest the disease. Assisted by Drs. Reynolds and White, a major application of mercuric cataphoresis was made, the instruments being passed through an asbestos tube impregnated with fused shellac to protect the vagina from both the stray current and the heat that is developed when a single electrode is employed to concentrate a high current. Five hundred to 700 milliamperes were employed for 2 hours. Peri-



FIG. 6. Case XLVII nine months after application, showing a V-shaped linear cicatrix.

tonitis, unfortunately, developed within a few days, the patient succumbing on the seventh day after the application.

CASE XLIX. This case represented an attempt to relieve the immediate suffering of a gentleman in Pittsburg Pa., who was already *in extremis* from a recurrent sarcoma of the palate, threatening suffocation. The growth extended from the palate through to the external parts below the right lower jaw, and had but recently been under an operation for its attempted removal. The pharyngeal growth was bloodlessly necrosed by 200 milliamperes, but the prolonged application and anesthesia were too much for the patient's strength, and he succumbed to shock 5 hours later.

CASE L. Mrs. E., aged 75, noticed a pimple beneath the inner canthus of the left eye 3 years before being first seen. Some months later it was removed at the Presbyterian Hospital, but later returned. She was placed under a very minute form of the minor method, not more than 3 to 5 milliamperes being employed without anesthesia for 10 minutes with 2 or 3 fine

zinc-mercury needles inserted about a millimeter each. This was repeated a number of times during 4 or 5 months. The tendency of the skin to contract when the germs are destroyed is well exhibited.

CASE LI. Mrs. S., aged 68, sent by Dr. Wm. B. Ulrich, of Chester, Pa. Six weeks before being first seen by me a pimple had appeared on the right side of the bridge of the nose. It was painless, but its rapid growth induced Dr. Ulrich to send the patient to Professor Duhring, of the University of Pennsylvania, for diagnosis. Dr. Duhring pronounced the growth an epithelioma and advised its removal by electricity. The patient was accordingly referred to the writer December 23, 1901. A photograph of the growth at this time was taken, the infected base being about the size of a copper cent, and an attempt was made to destroy and sterilize it by a slightly stronger series of office applications similar to those employed in the preceding case. It was soon seen, however, that these mild applications were worse than inadequate, seeming in fact to stimulate the growth, which rapidly enlarged. We had to deal with a rapidly progressive carcinoma.

A major application was therefore made January 16, 1902, 200 milliamperes being used with fine zinc-mercury points for 50 minutes, assisted by Drs. Ulrich and Hermance. This resulted in complete arrest of the growth, which was found to involve the nasal bones, the latter coming away as sequestra 3 months later.

CASE LII. A granular surface growth of the chin, of long standing, but unknown character, was removed by zinc-mercury needles in one application under cocaine, March 3, 1902, 50 milliamperes being required for 15 minutes. Complete healing and disappearance of the growth resulted.

CASE LIII. R. W., aged 50, was sent by Dr. Leonardo Judd, March 28, 1902, with a diffused area of diseased tissue on the outer surface of the right arm about 4 by 3 inches in superficial area. The growth began 3 years before and gives him much pain. According to the patient, several surgeons in various hospitals declared that the arm would have to be amputated to get rid of the trouble. That it extended deeply into the muscular tissue was shown subsequently when the eschar produced by the application came away.

This growth, though of unknown histological character, for the microscopist failed to make a diagnosis from the piece removed for that purpose, appeared to be a typical one in which to try the effect of Röntgen rays, but the patient was a working man whose time was valuable to him, and it was decided to employ the major method of zinc-mercury cataphoresis. He was accordingly placed under ether the next day, and assisted by Dr. Hermance and Dr. Goethe, of Georgia, I was able to destroy the growth and sterilize its base in exactly 30 minutes, employing 350 milliamperes. At the present time the diseased area is healed over, except a small spot in the center which bears evidence of being healthy.

Of the above fifteen cases it will be seen that nine cases appear to be cured, two cases were temporarily helped without arrest of the

disease, and four cases died shortly after the application was made. The widely differing character of these cases and the desperate nature of those terminating fatally give, however, very little ground for a statistical inquiry, the chief value of this report lying in the study of the individual cases described.

Five of the cured patients were demonstrated at the meeting.

DISCUSSION.

DR. G. G. DAVIS said that he considers it a matter of simple justice to Dr. Massey that there be some testimony as to what other people think of his cases. Personally, he fails to see in any of the patients present evidence of carcinomatous disease, there being an apparently healthy granular surface and an absence of induration around the edges. Therefore, he thinks there is no doubt but that the treatment does eradicate local carcinomatous growths, and he is somewhat surprised that the method has not been given a wider trial. The method is practically the use of electrolysis combined with the chemical action of the zinc and mercury. The method has the advantage of being capable of being applied repeatedly, and while he would not say he preferred it to other methods, he has not the least hesitation in saying that he believes it to be a perfectly legitimate, rational and, in many cases, an effective method of treatment. The performance of the technique requires trouble, expense and work, and while these may be excuses, he does not regard them as proper reasons for not giving the method more extensive trial.

DR. MASSEY in closing said that he wanted to remind physicians that cancer is a local disease and should be treated early. Though this is well known, many needed to be reminded of the fact. No doubt many present had patients consult them months and even years after the inception of the disease, when a day only is necessary for a metastatic extension to inaccessible regions.

Diagnosis and Treatment of Tubercular Arthritis.

BY JAMES K. YOUNG, M. D.

[Read at the South Branch, January 24.]

There are certain etiological facts connected with tubercular arthritis, whether it occurs in the spine, hip, knee or other joints, which are valuable in arriving at a correct diagnosis. These are age, sex, heredity and traumatism. It is a well known fact that 80 per cent. of cases of tubercular arthritis occur before adult life. It is also well known that males are more frequently affected than females

and that a hereditary tendency to these affections, together with traumatism, is an important element in the location of the disease in certain joints.

There are also certain signs, or cardinal symptoms, which stand out prominently as danger-signals on a rocky coast, such as spasm, atrophy, pain and night cries. Too little attention is paid to early fixation of a joint by muscular spasm due to irritation. This is reflex in character—tetanic—and leads to the fixation of the part. Sooner or later it is followed by atrophy of the contracted muscles. The pain which accompanies tubercular arthritis is too frequently referred to the peripheral distribution of the nerves. Thus we have in spine disease the pain referred to the anterior portion of the body, and in hip disease the pain referred to the inner side of the knee. The occurrence of night cries is a symptom which is very significant of an extension of the disease to some other part of the joint, especially ulceration of the cartilage. They are characteristic of the second stage of tuberculous disease.

With due attention to these symptoms, and without the occurrence of complications such as abscess or paraplegia, the diagnosis of tuberculous disease in the joints should be made early.

Another significant fact to which sufficient attention has not been given is the antagonism existing when tuberculous disease is suspected in different parts of the body. Tuberculous disease of the hip seldom occurs coincidentally with phthisis or with tuberculous disease of the glands of the neck. Tuberculous disease of the hip is seldom associated with tuberculous disease of the spine. While lesions may occur in several different joints, they are never active at the same time. One will be active while the other is quiescent. Given an active tuberculosis in one part, it is very unusual to have an active process going on in another part of the body.

This is well illustrated in a patient who died this week from amyloid disease following hip disease. All the internal organs were in an advanced state of amyloid degeneration. The hip joint had been excised some time previously, the ilium was extensively diseased, and yet the lungs were affected by only a very small focus of disease.

Differential Diagnosis.—The number of diseases from which tuberculous arthritis must be differentiated has increased greatly in the past one hundred years. Before the time of Brodie but two diseases of the joints were recognized—white swelling and arthritis. From a recent chart prepared by the writer to illustrate the different pathological processes with which the joints are affected, it was found that there were about fifty distinct pathological lesions. The differential diagnosis between arthritis, say of the knee joint, and of syno-

vitis, the disease with which it is most frequently confounded, brings out the different points stated above.

NONTUBERCULAR CHRONIC SYNOVITIS.

1. Marked effusion, capsule thickened.
2. Joint outline enlarged and obliterated.
3. Motion nearly normal.
4. Reflex muscular spasm absent.
5. No atrophy.
6. Pain absent.
7. Limp absent.
8. Night cries absent.
9. Relation of femur and tibia normal.

TUBERCULAR CHRONIC ARTICULAR ARTHRITIS.

1. No fluctuation, capsule not thickened.
2. Joint outline distinct and clear.
3. Motion limited.
4. Reflex muscular spasm present.
5. Marked atrophy.
6. Pain acute upon motion.
7. Limp present.
8. Night cries present.
9. Tibia subluxated.

(AFTER SHAFFER.)

Tubercular arthritis should be diagnosed from specific arthritis. The slight fluctuation, the induration and enlargement of the joint, the limited motion, the absence of reflex muscular spasm, the slight amount of atrophy present, the presence of pain upon motion, and the absence of night cries, would serve to distinguish this affection. This differential diagnosis does not vary greatly in nontubercular chronic synovitis, but the history and the effect of constitutional remedies would be of use in clearing the diagnosis.

The disease with which tuberculosis of the joints is most frequently confounded in infancy is articular rheumatism. Rheumatism in childhood is such a rare disease that the occurrence of joint disease should be very carefully investigated for the cardinal symptoms which have already been given. When spasm, atrophy, peripheral pain, etc., occur in a single joint, great care should be taken to avoid an error in regard to the real cause of the disease.

A rare affection with which tuberculous disease is sometimes confounded is sarcoma of the joints. This is most apt to occur in the spine, and in this region it can be differentiated by the history of malignancy in the ancestors, by its rapid course, the early appearance of cachexia, local tenderness, the absence or rounded appearance of the deformity, the absence of abscesses, the early and complete paraplegia, the emaciation and anemia which occur early, and the metastasis which occurs to other organs, especially the liver.

X-ray photography furnishes an important means of diagnosis. By it we can distinguish the amount of destruction of bone tissue present, and can easily distinguish between the presence of synovitis

or arthritis. In synovitis the outline of the joint is clear and distinct, whereas in tubercular arthritis the joint outline is roughened, irregular and worm-eaten.

Treatment.—The treatment of tuberculous disease of the joints consists of three parts—constitutional, mechanical and local.

The constitutional treatment of joint disease should be as thorough and painstaking as the treatment of tuberculous disease in other parts of the body, and should include the improvement of the hygienic surroundings even to the change of climate, and particularly should the patient be sent to high, cold altitudes or to the seashore.

The mechanical treatment of joint disease may be summed up in one word—traction—which is the result of experimentation and clinical experience of many years' standing. Traction may be applied by means of apparatus or by extension appliances of different forms, but whatever the means it should be thorough and should be continued for a very long time. By traction methods recovery from joint disease of tuberculous character will sometimes be effected, while by other methods the results will be less satisfactory and will frequently lead to the total destruction of the joint.

The local treatment of tubercular arthritis by means of iodoform injections is very valuable in the smaller joints, as in the elbow, wrist, etc., but in the knee and hip I have not found it of any benefit, and usually the injections acted as a foreign body and had to be removed by incision. One dram of a 5 per cent. solution can be thrown into the wrist or elbow joint. The part should be fixed during the reaction, and constitutional remedies should not be neglected.

The operative treatment of tubercular arthritis should be thorough when it is required; and there are two points which should be insisted upon in all operations upon the joints; first, the preservation of the body heat, and secondly, rapidity of operation. At one of the hospitals with which I am connected we have in operation an electric mattress which has proven very valuable in preventing the loss of body heat, and has also prevented shock in the majority of cases. There are few operations in surgery in which the shock is more profound than in excision of the hip, which formerly was considered equivalent to amputation at the same point, but at present with the improved methods which have been introduced in the amputation of the hip the former operation is often the more serious.

Rapidity of operation is quite as important in orthopedic surgery as in acute surgery, although it requires more experience and greater skill to perform these difficult operations rapidly. In the knee, for example, if an excision can be performed in thirty minutes it should not be prolonged for two hours. The watchwords in operations of this kind

should be "Quickly, safely and well." Many years ago I witnessed an operation for ankylosis of the knee joint which required so long a time that I left before it was completed. Much delay in operations may be avoided by planning well before beginning to operate, by having a good corps of assistants, and by rapid manipulation at the time of the operation.

In children erosions of the joints, not formal excisions, are greatly to be preferred, as they interfere less with the growth of the part and may be repeated should occasion require. Excisions of the joints are to be preferred in adults unless the condition of the joint requires amputation.

Treatment of Abscesses and Sinuses.—The treatment of abscesses and sinuses forms an important part of the treatment of tubercular arthritis.

In the greater number of cases abscesses will require incision, but a slight proportion, if they are small, may be allowed to remain unopened. If they are large, if they are increasing in size and if they are making pressure on important organs, incision should at once be made. The surgeon should be prepared at the time of making the incision to proceed to a more thorough operation upon the joint if the examination prove it to be necessary. In this way much loss of time may be prevented. On one occasion I had to wait a week to obtain the permission of a parent to perform an excision of the hip joint after I had done an incision of an abscess.

If the contents of the sac can be removed at the time of operation this should be thoroughly done, but if it is so extensive that it cannot be removed the sac should not be manipulated for fear of causing absorption of the tuberculous matter and the production of tubercular meningitis. The cavity of the abscess should be washed with 1-4000 bichloride, with peroxide 50 per cent. and an emulsion of iodoform oil, 5 per cent. should be thrown into the cavity. A drainage tube should be inserted or a packing of iodoform gauze should be left in the wound for the purpose of drainage. In some instances after the thorough removal of the sac by curettage or with forceps and scissors, the cavity may be thoroughly rubbed with gauze pads and closed by sutures without drainage.

The treatment of sinuses following tuberculous abscesses is the *bête noire* of orthopedic surgery at the present time.

If the rubber drainage tubes are not allowed to remain in too long, and if the packing is diminished as quickly as possible, the sinuses will more frequently close than if these points are omitted. The closure of the sinuses may often be hastened by curettage and by the use of pure iodine applied to the walls by means of an applicator. The

sinuses should not be closed as long as there is any necrosed tissue at the bottom of the wound, and granulation should be encouraged from the bottom of the wound.

The closure of the sinuses following tuberculous arthritis is frequently followed by disease elsewhere, and this has led to the belief among the laity that the closure of sinuses is not a proper method of treatment. Not infrequently the sinus closes spontaneously because of the occurrence of disease elsewhere. This is well illustrated in a lad who suffered from a large number of sinuses about the hip joint, and who in the course of hip disease developed phthisis, the sinuses closing abruptly upon the onset of the latter disease. If the necrosed tissue has been properly removed there will be no danger in the healing of the sinuses.

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PROCEEDINGS
OF THE
Philadelphia County Medical Society.

The Value of Diphtheria Antitoxin.

BY M. HOWARD FUSSELL, M. D.

[Read September 10.]

"In ten years all your antitoxin syringes will be in the ash-barrel, and you will be ashamed that you ever were guilty of using antitoxin for diphtheria." The above expression was used but a few months ago by a gentleman enjoying a large private practice and holding a responsible position as chief of a hospital ward in this city. So long as reputable physicians either from prejudice or other mental aberration hold such views as the above, an article is not out of place on what at first seems a subject well threshed out, and upon which two opinions could not be held. That some men still are unbelievers in the efficacy of diphtheria antitoxin seems to the writer explicable largely upon two possibilities.

First.—The statistics of certain cities, notably Philadelphia, in which reporting of contagious diseases is obligatory, and where homes are placarded, make the mortality from diphtheria at from 25 per cent. to 30 per cent., a figure very little if any less than that which was the fact before antitoxin was used, and before houses were placarded. This can be explained, I am sure, by the fact that very many men, certainly in my own district, do not report cases of contagious disease, to prevent the house from being placarded, unless the case is a desperate one and death seems probable. All mild cases and the majority of moderately severe ones are never reported to the Board of Health and, consequently, cannot figure in the statistics.

Second.—It is a lamentable fact that many physicians, holding

perhaps but slightly modified views from the one quoted, either do not use antitoxin at all or they use it in small doses and late in the course of the disease.

When the gentleman quoted was asked if he never used antitoxin, he answered, "Oh yes, but only to satisfy the family!" It is unnecessary to say that such use is a little worse than useless.

These two facts alone, it would seem to the writer, must explain in a large degree, the statistics of cities which give a high death rate in diphtheria, and a good explanation why certain reputable men are still unbelievers in the efficacy of diphtheria antitoxin.

This paper is based on personal experience and will not deal with statistics. Suffice it to say that in the district in which the writer works there is always more or less diphtheria and there has been since he began practice eighteen years ago.

The type of the disease in the past eighteen years has been the same, many mild or moderately severe cases and occasional very severe or malignant cases. Frequently laryngitis has been the first symptom of the disease. There has been no change in the type, I repeat, since the use of antitoxin.

The writer's experience before the advent of antitoxin was about as that of other practitioners. He had no specific, he was forced to rely upon keeping the affected region as clean and as nearly aseptic as possible, upon the use of tincture of the chloride of iron, upon the use of tonics for the heart, upon stimulants and nourishment. If happily the child was robust, and the dose of poison received into the system not overwhelming, the child recovered. If, on the other hand, the dose of poison was great or the resistance feeble death ensued.

If laryngitis was the first symptom, or a complication, death almost invariably ensued. Tracheotomy in croup cases, whether performed by myself or by expert surgeons, was invariably followed by death, in my private work. Intubation occasionally, but very seldom, was followed by recovery.

I felt at the time, and still think that I occasionally saved life by the timely use of local applications, the use of food and stimulants or by surgical interference. I always felt, however, the greatest trepidation in dealing with diphtheria, and knew that my patient was in the hands of a merciless enemy.

The uncertainty of treatment ten years ago, is well illustrated by two typical cases:

CASE I. Marion C. developed gradually a hoarseness. I saw her on the second day. There was a very slight rise of temperature, there was total loss of voice, over both tonsils there were small patches of tightly adherent membrane. There was no difficult breathing. The case was recognized as one of diphtheritic croup and treated with atomized lime, local application to the tonsils and pharynx and tonics. Gradually the voice became whispering, stenosis of the larynx ensued, and gradually increased. Before the child was in extremis, Dr. Wharton skillfully performed tracheotomy with relief for a few hours; then the bronchi became affected and the girl of 10 years died miserably of suffocation.

Here was a case seen early, treated in the best known manner, a surgeon called in early, and yet the disease steadily pursued its relentless course, until death ensued. This was my usual experience in such cases.

CASE II. O. M., boy of 6. One of moderate pharyngeal diphtheria, treated with iron, local applications and tonics. The membrane all disappeared, but a gradually increasing nephritis occurred, which ended in death from that complication.

Of course there were severe cases which recovered, but the occurrence of such cases as the above, made me feel that the doctor had absolutely no specific, and that death or recovery depended largely upon the dose of poison and the amount of resistance manifested by the patient.

Now all this is changed. Since I have been using antitoxin I have had *one* death in which the specific was used, and that death occurred eight hours after my first visit (the child had been ill two days) and seven hours after the administration of the antitoxin. I now feel, when called to a case of diphtheria that the case will surely recover, provided I have seen it early in the course, and will *probably* recover even though the case is severe and seen rather late. Every case of laryngitis I have seen has recovered. On two or three occasions I have been forced to resort to intubation, but never to tracheotomy. The mild cases all recover with the administration of 1,000 or preferably 2,000 units of a reputable make of antitoxin.

That no mistake in my judgment as to the nature of the cases has occurred is proven by the fact that I invariably make cultures in every throat case, so that I have not given antitoxin the credit of curing cases of follicular tonsilitis which would have recovered without its use. The cases which received antitoxin and were recorded as

diphtheria were all true diphtheria, as proven by the presence of Klebs-Löffler bacilli in the throat.

The following cases are illustrative of what occurs in the constant early use of antitoxin and are the grounds for my belief in the remedy:

CASE III. Milton F., my son, aged 8 years, was not feeling very well for 2 or 3 days. A careful examination of his throat and other organs failed to show anything upon which a diagnosis could be made. On the evening of November 26, 1901, his mother sent him to the office to have his throat examined as he said it was sore. There was no fever, and apart from a slight pharyngeal redness his throat was normal. Suddenly, at 3 A. M. on the next day, I was awakened by the child giving a severe, loud laryngeal cough. I spoke to him and his voice was perfectly clear. I then looked at the throat, and much to my horror, found both tonsils covered with a thick membranous exudate. By 4 A. M. the child could not speak above a whisper and the visible exudate had decidedly increased. At 4.30 A. M. he received 4,000 units of antitoxin at one dose. He received some strychnine as a tonic and a mixture of tincture of the chloride of iron and mercury bichloride internally. He was isolated and recovered without a bad symptom. A culture showed a pure growth of Klebs-Löffler bacilli.

So far as we may speak of what is not absolutely proven, this case would have died miserably within twenty-four hours. Many such cases have come under my observation, where death was the immediate result, before the use of diphtheria antitoxin. The case shows also the value of the early administration of a relatively large dose.

The following case, seen in consultation, demonstrates two facts. The error in giving one dose of antitoxin and not repeating it one or more times if improvement does not follow and the value of antitoxin late in the course of a case.

CASE IV. Child, female, aged 3 years, seen with Dr. Rowe, of Falls of Schuylkill. Five days before I was called the child had been attacked with pharyngeal diphtheria, was given 1,000 units of antitoxin and improved so that some of the membrane disappeared from the throat. I saw her late in the evening of the sixth or seventh day, almost in *extremis* from laryngeal stenosis. There was considerable exudate in the throat, there was apparently some consolidation at the right apex of the lung, indicating that at least collapse had taken place if not actual inflammation. The child was at once given 2,000 units of antitoxin and Dr. John H. Jopson was called to do a tracheotomy. He chose an intubation, which he did most skillfully. The child was immediately relieved of the symptoms of stenosis, but the breathing still remained rapid, and there was continued retraction of the epigastrium.

The next morning 2,000 units more of antitoxin were administered. From that time the child gradually improved, and at the end of 2 weeks was entirely well.

I believe this child would have died if intubation had not been performed and would have died even with that help if the administration of antitoxin had not been continued. A pure culture of diphtheria bacilli was found in the throat.

The effect upon a severe case when the remedy is given early and in efficient doses, is shown by a case which came under my care the day I left the city on my vacation. The patient was continued under the intelligent care of Dr. C. K. Dengler.

CASE V. John C., aged 12 years, was taken sick with sore throat August 17, 1902. I first saw him in the evening of August 19. He had a temperature of 103°. The entire pharynx was coated with a thick, dirty membrane. The glands at the angle of the jaw were much involved and greatly swollen. The voice was clear. He was immediately given 2,000 units of antitoxin, at 11 P. M. The next morning, at 10 o'clock, as the symptoms were about the same, he was again given 2,000 units. In the evening he was better but the voice was husky. By 10 P. M. he had severe laryngeal stenosis; was given 2,000 units more antitoxin although the membrane in the pharynx was beginning to disappear. In a few hours a large piece of membrane was coughed up and the stenosis entirely disappeared. The child made an uninterrupted recovery.

Two other children in this home had a slight attack of diphtheria which was cut short by the immediate administration of 1,000 units of antitoxin. A fourth child was given an immunizing dose of 500 units and did not develop the disease.

While I make it a rule to take a culture of all throat cases, I do not wait for the result of the culture before administering antitoxin in doubtful cases. I have frequently given a dose of antitoxin where the culture showed afterward that diphtheria was not present. There were absolutely no unpleasant effects.

CASE VI. George F. was taken ill with temperature of 104°, sore throat and general malaise, while his brother was ill in the house with true diphtheria. Antitoxin, 2,000 units, was immediately administered without any effect good or bad upon the case. Repeated cultures showed the absence of diphtheria bacilli.

Basing my practice upon personal experience, and being taught by the experience of others, I believe it is a good thing to administer an immunizing dose to the children of a family in which a case of

diphtheria exists. I have for some time felt that we had at hand such a certain specific in antitoxin, that we could safely await the development of the disease before administering the antitoxin. Jump's experience, however, of a fatal case developing in a child watched but not given an immunizing dose, shows the danger of such a course, and now I always administer 500 units to the unaffected children of the family.

I believe that the following statements will be found safe rules to follow and will hold good in the vast majority of cases.

If these rules are followed, I believe that the mortality of diphtheria will be about *nil*, instead of 30 per cent. or thereabouts, as it is apparently in Philadelphia at the present time.

1. Always make a culture in throat cases, diphtheria cannot be certainly diagnosed without.

2. When called to see a case of sore throat which is doubtful in character, give antitoxin *at once* and make the diagnosis by culture afterward.

3. When a case of undoubted diphtheria is seen, administer 2,000 units *at once*. If there is no improvement in six hours, administer 2,000 units again. Every twelve hours thereafter administer 2,000 units until improvement begins.

4. Always give a large dose; 2,000 to 4,000 units in my hands has proven sufficient, but in desperate cases much larger doses may be used, as proven by the Boston experience.

I believe that, given a case of diphtheria in an early stage, it is only a matter of administration of *enough* antitoxin to effect its cure. If one *waits*, even in apparently mild cases, fatal pathological changes may occur in the organs which will make death or invalidism certain.

DISCUSSION.

DR. R. A. CLEEMANN said that his experience coincided with that of Dr. Fussell. Formerly, when called to a case of pseudomembranous croup he approached it with great anxiety, feeling almost certain that the child would die; now the reverse was true. He differed with Dr. Fussell and others in that he had not found appreciable results to follow in so short a time as within 6 hours of the administration of the antitoxin. As a rule it was 24 hours before any decided benefit appeared from the use of the antitoxin. This was only important in the matter of expense. Usually he found that a single dose of 2,000 units was sufficient.

DR. WILLIAM M. WELCH said that antitoxin is used freely in the Municipal Hospital, in doses from 2,000 to 6,000 units and repeated according to cir-

cumstances. Many patients receive 8,000 to 10,000 units in the course of the disease, and some few a much larger quantity. The largest amount given to any single patient was forty-odd thousand units. He did not know what to say about the value of antitoxin. The death rate among severe cases is still very high. He would like to try the experiment of administering it to every alternate case for a definite period and watch the results, but he felt that the present state of the question would not permit of this. He said that many physicians were considerate enough to say that patients were not received into the Municipal Hospital sufficiently early to show the real value of this treatment. The best effort possible is made to save them in that the antitoxin is administered immediately upon their admission. Practically all of the patients sent into the diphtheria wards under mistaken diagnoses immediately receive the customary dose, and they but seldom take diphtheria. This may be because of the immunity conferred by this agent.

DR. GEORGE E. DE SCHWEINITZ spoke of the disastrous results in diphtheria of the conjunctiva prior to the use of antitoxin, and quoted statistics upon the subject, and referred to the results achieved by Myles Standish in Boston, and in England by Sydney Stevenson and others. He thought it safe to say that if the diphtheritic character of the membrane on the conjunctiva is recognized early enough and antitoxin in suitable dose promptly given the eyesight is always saved. If the diphtheritic character of the membrane is not recognized early, or if the old fashioned treatment is used, total destruction of the eyesight is a usual result. Regarding Dr. Welch's suggestion of experimenting in alternate cases; he said that with the eye he believed this had been done; he further believed that the patients who received the antitoxin were more promptly and satisfactorily relieved than the others. Severe diphtheria of the conjunctiva is not frequently seen in Philadelphia and hence Dr. de Schweinitz's own experience is limited, but based upon large statistical information from elsewhere he has reached the opinion that it would be little short of criminal not to use antitoxin in diphtheria of the conjunctiva.

DR. W. S. STEWART inquired whether Dr. Fussell used any other remedies or depended upon the antitoxin alone? He said that he had been a convert to the use of antitoxin from the very necessity of protecting himself from reflections for not using it. Since 1861 he had treated cases of diphtheria altogether with remedies, both internal and local, such as potassium chlorate in saturated solution internally, repeated until its good effects were produced; iron subsulphate as an astringent was applied on a mop to the throat, and was also used as a gargle in one dram to the pint of water. From these remedies he had seen excellent results. Some cases did not show results as promptly as desired and he began the use of antitoxin. Its use had proved itself valuable as a material aid to the other remedies taken by the patients. His results have been better than he had anticipated and he felt that it would be considered now almost criminal not to use antitoxin in pure cases of diphtheria and membranous croup.

DR. FUSSELL said that he agreed with Dr. Cleemann that, as a rule, results were not manifest in less than 12 hours. He gives a second dose of antitoxin rather than wait 12 hours only when the condition continues to grow worse. He was glad to hear Dr. Welch's remarks concerning the use of anti-

toxin. His own feeling regarding the unfavorable results in the Municipal Hospital was that they were accounted for by the fact that the patients were received in that institution late in the course of the disease. The very beautiful specimens of the lesions developing in the course of diphtheria shown by Dr. Pearce demonstrated why nothing could cure the disease after it had continued for 24 or 48 hours. He uses, in addition to the antitoxin, strychnine and whiskey; but no local treatment except a gargle of boric acid or salt solution to keep the parts clean.

Leukocytosis in Lead Workers.

BY L. NAPOLEON BOSTON, M. D.

[Read September 10.]

During the past much attention has been devoted to a study of the changes that develop in the erythrocytes (basic, granular or punctiform degeneration) both in lead-workers and those showing evidence of lead intoxication.

My attention was first directed to the leukocytes in this condition in 1897, when I noticed that many of the patients admitted to the Philadelphia Hospital, from the various lead works of the city, showed a leukocytosis ranging from 10,000 to 20,000 cells per cmm. It has been my privilege to study sixteen cases in the Philadelphia Hospital; three in the Medico-Chirurgical College Dispensary; and five from private practice. Of these twenty-four cases two were painters, one a plumber who used lead in the calking of joints; another a lapidary who used an emery pencil which he repeatedly placed to his lips while at work, and the remainder had been employed for a variable length of time in either paint or lead works. The longest period any patient had worked before symptoms developed was twelve years; the shortest six weeks. Most of them, however, were affected in from four to nine months after entering the lead works.

The variety of work appeared to exercise but little etiological influence, though in all cases where special care had been taken to cleanse the hands thoroughly before the taking of food, symptoms developed late, but were always severe. For example: The man who had worked for twelve years without any discomfort, died of general paralysis a few days after the first intestinal cramps were noticed.

Three of the cases gave a leukocyte count below 10,000, and were 4,000, 7,200 and 8,000 respectively. The remainder gave counts

varying between 10,500 and 25,000. The number of red cells and the percentage of hemoglobin bore no constant relation to the number of leukocytes present. In the case showing 7,200 leukocytes the patient had been under treatment several weeks. The other cases in which the leukocyte count was below 10,000 the history gave that of lead poisoning some months or years before; which suggests the possibility that leukocytosis may develop in connection with the primary condition only.

R. C. Cabot, in the study of fifteen cases with eighteen blood examinations gives an average leukocytosis of 12,922, the maximum number being 23,400, the minimum 4,500. In my series the average number of leukocytes was 12,600; the greater number being 25,500, the smaller 4,000.

A moderate reduction in the number of erythrocytes to 3,500,000 is the rule, yet in severe cases they may fall below this number. One of my series gave a count of 2,700,000. In a few instances, however, the red cells are found to be above the normal, as was observed in four cases of my series which showed 4,760,000, 5,090,000, 4,940,000 cells per cmm. respectively.

The hemoglobin was found to fluctuate between 32 and 85 per cent. No constant ratio was found to exist between the number of red cells and the percentage of hemoglobin, as is shown in the four cases of polycythemia above cited, in which the respective amounts of hemoglobin were 46, 32, 79 and 85 per cent. In the latter case the exposure to lead had been of short duration, and the symptoms mild, however the line about the teeth was fairly distinct.

Smears made from the different cases and fixed by heat were alike in displaying a rather high grade of poikilocytosis; the erythrocytes staining feebly in many instances; many appearing as mere shadows; while in others certain cells stained irregularly.

Overstained cells were uncommon. Macrocytes and microcytes were numerous and nucleated red cells an occasional finding; of these normoblasts were the commoner.

The following is a report of the blood examinations, with brief remarks as to the general clinical pictures of nine of the cases of this series, eight of which presented basic degeneration of the red cells.

CASE I. S. M., male, aged 42 years, first began working in a paint factory 6 months before consulting his physician, when there were present constipation, intestinal cramps, obstinate vomiting and a distinct line on the

gums. The red cells were found to be 3,335,000; white cells 14,000; hemoglobin 60%. A differential leukocyte count gave polymorphonuclears 68.5%; lymphocytes 16%; large mononuclears 7%; transitionals 3.5%; myelocytes 4%; eosinophiles 0.5%. One megaloblast and one normoblast were seen while counting 400 leukocytes. Six days later when the patient was able to go about the street, the red cells were found to be 3,200,000; white cells 11,800; hemoglobin 69%. Eighteen days after the first symptoms the red cells numbered 3,109,000; white cells 15,200; hemoglobin 68%. A differential leukocyte count showed polymorphonuclears 64.5%; lymphocytes 20.5%; large mononuclears 9.0%; transitionals 1.5%; myelocytes 1.5%; eosinophiles 3%. On the sixteenth day of his illness the red cells were 3,714,000, white cells 13,400; hemoglobin 59%. A differential count of the leukocytes gave polymorphonuclears 68.5%; lymphocytes 14.5%; large mononuclears 10%; transitionals 2.5%; myelocytes 2.5%; eosinophiles 2%. One normoblast seen while counting 400 leukocytes. There were observed marked irregularity in the staining of the erythrocytes, moderate poikilocytosis, many macrocytes and microcytes and cells showing basic degeneration.

CASE II. P. C., male, aged 33 years; had been employed in a lead works for 6 months in 1897, when he was forced to give up the work on account of intestinal colic. He returned to the same variety of work 3 months ago and now complains of loss of sleep, anorexia, cramplike pains in the abdomen and weakness of the arms and hands. There are present wrist drop and a line on the gums. The red cells were found to be 2,930,000; white cells 8,000; hemoglobin 50%. A differential leukocyte count gave polymorphonuclears 62.5%; lymphocytes 26.5%; large mononuclears 4.0%; transitionals 3.0%; myelocytes 2.0%; eosinophiles 2%. Ten megaloblasts and 4 normoblasts were seen while counting 400 leukocytes. Many of the red cells stained as mere shadows and poikilocytosis was excessive as was also the basic degeneration.

CASE III. J. C., born in Ireland, aged 42 years, had been employed in a lead works for 12 years, without any symptom of lead intoxication. During the last 2 weeks there were slight intestinal pains. There were tremor, vomiting, constipation, pallor, great prostration and a decided line on the gums at the time of my first visit; 24 hours later he developed extensive paralysis, and lived but a few hours. The red cells were 4,940,000; white cells 20,800; hemoglobin 87%. A differential leukocyte count gave polymorphonuclears 88.5%; lymphocytes 7.5%; transitionals 2.0%; myelocytes 2.0%; eosinophiles 0.0%. The red cells stained well and were fairly normal in outline. Smears stained with carbol-thionin showed areas of basic degeneration in the red cells.

CASE IV. M. L., male, aged 54 years, a painter. The line on the gum was distinct, and there had been cramp-like pains in the abdomen. The red cells were 5,500,000; white cells 11,200; hemoglobin 79%. A differential leukocyte count gave polymorphonuclears 71.5%; lymphocytes 21.5%; large mononuclears 5.0%; transitionals 1.0%; eosinophiles 1.0%. No nucleated red cells were seen; but cells showing the basic degeneration were common.

CASE V. J. S., male, aged 44 years, had been employed in a paint factory during the past 12 years. There were now a line on the gums, decided tremor and wild delirium. The red cells were 3,810,000; white cells 13,200; hemo-

globin 32%. A differential count of the leukocytes gave polymorphonuclears 65.5%; lymphocytes 21.0%; large mononuclears 8.0%; transitionals 1.0%; myelocytes 1.5%; eosinophiles 3.0%. Red cells stained feebly and many of them showed the basic degeneration.

CASE VI. J. H., male, aged 34 years, had been working in lead during the past 3 months. Five days before coming to the clinic he noticed mild intestinal pains; but was able to work. Had an attack of lead colic some years before. The red cells were 5,090,000; white cells 7,200; hemoglobin 37%. A differential leukocyte count gave results quite different from those previously reported. Polymorphonuclears 48.0%; lymphocytes 40.0%; large mononuclears 6.0%; transitionals 2.5%; myelocytes 1.0%; eosinophiles 2.5%. There was some irregularity as to the size and staining of the red cells and many of them showed basic degeneration. Two megaloblasts were seen while counting 400 leukocytes.

CASE VII. R. D., male, aged 42 years, an Austrian, was admitted to the medical wards of the Philadelphia Hospital; but on account of not speaking English no history could be obtained. There was evidence of severe intestinal pain and a line on the gums. The blood examination was not made until the patient had been under treatment 3 weeks, at which time the red cells were 3,700,000; white cells 7,000; hemoglobin 37%. A differential count of the leukocytes gave polymorphonuclears 63.0%; lymphocytes 28.5%; large mononuclears 4.5%; transitionals 2.0%; myelocytes 2.0%; eosinophiles 0.0%. Four normoblasts and one megaloblast were found while counting 200 leukocytes. The red cells showed a moderate grade of poikilocytosis.

CASE VIII. J. J., male, aged 30 years, who had been employed for some months in the calking of lead joints, came to the clinic complaining of moderate loss of strength, anorexia and sleeplessness. There was a distinct line on the gums. The red cells were found to number 2,770,000; white cells 4,000; hemoglobin 51%. A differential count of the leukocytes gave polymorphonuclears 60.0%; lymphocytes 30.0%; large mononuclears 3.5%; myelocytes 4.0%; transitionals 2.0%; eosinophiles 0.5%. Four normoblasts were seen while counting 400 leukocytes. Poikilocytosis was well marked, as was also the basic degeneration. The patient did not return to the clinic, and efforts to locate him were of no avail. He volunteered the information that he had had a similar attack 3 years before; which makes the second case in this series wherein the patients had suffered a previous attack of lead intoxication, and in both these cases was noted the absence of leukocytosis; yet the destructive changes in both the erythrocytes and the hemoglobin were equally well marked.

CASE IX. A. N., male, aged 42 years, had been employed in a paint factory during the past 4 months. There was a line on the gums and he had been confined to his bed for several days as a result of intestinal pain. The red cells were found to number 4,760,000; white cells 25,500; hemoglobin 46%. The differential leukocyte count showed polymorphonuclears 58.0%; lymphocytes 33.0%; large mononuclears 3.25%; transitionals 1.5%; myelocytes 3.25%; eosinophiles 1.0%. Five normoblasts and one megaloblast were seen while counting 400 leukocytes. All the red cells stained feebly, and a high grade of poikilocytosis was present. The basic degeneration, also, was marked.

SYMPOSIUM ON TYPHOID FEVER.

[September 24.]

Hemorrhage in Typhoid Fever.

BY ROLAND G. CURTIN, M. D.

With the exception of failure of the heart and perforation, there is no complication of typhoid fever that so suddenly presents itself as hemorrhage—often when the case seems to be pursuing a satisfactory course. It is essential that we should be constantly on the lookout for symptoms indicating either frank or concealed hemorrhage; and that, when these are once discovered, prompt treatment should be instituted. Delays at this critical period are dangerous.

Etiology.—The exact etiology of this unfortunate complication is hard to explain. Why some cases should have hemorrhages and others, much more severe in every way, should not, may perhaps, be best explained by taking into consideration the profound changes that take place in the blood of typhoid patients. The partial or total disappearance of fibrin must interfere with the coagulability of the blood and, therefore, increase the tendency to hemorrhage.

In different epidemics, the percentage of hemorrhagic cases in adults varies from 3.5 to 8 per cent. In taking statistics from the different hospitals, it has been found that in some years hemorrhage is exceedingly rare, while in others it is quite a common complication. This is explained by the fact that in some epidemics the sloughing in the bowels is greater than in others, and that the blood changes vary with the severity of the toxemia.

I have never seen a case of hemorrhage from the bowels in a child under six years. Statistics have been compiled, and it has been found that in children under fifteen the hemorrhage occurs in only from 3 to 4.5 per cent. It is very much more common between ten and fifteen years than between five and ten. It is curious that such should be the case, because the tissues of a young child are so much softer and more delicate than those of an adult, and the circulation is so much more active; but again, we must remember that the delicate bowel of a child is not so deeply eroded in typhoid fever as is that of an adult, and the sloughing does not seem to be so great. This, perhaps, accounts for the rarity of hemorrhage in young children.

In 232 cases under fifteen years of age observed by Taupin,

Rillet and Berthez, this complication occurred but once. Morse has collected some statistics showing the percentages, in children, of hemorrhagic cases. In seventy-seven children under ten years there was no hemorrhagic case; in 204 between ten and fifteen years there were nine instances, but without a death. Therefore, the mortality in young children seems to be low.

The following paragraph is quoted from Hand and Walker's series of Seventy-one Cases of Typhoid in Children under twelve years, treated in the Children's Hospital, Philadelphia, in 1901:

"Intestinal hemorrhage occurred in four cases, the amount of blood in the stools of three being very slight and scarcely enough to be called a complication. In one case there were three passages, each containing considerable blood, but without any shock or interruption to the favorable course of the case.

"The deaths numbered three, a mortality of 4.2 per cent. One case died of noma, one of diphtheria and one of toxemia; the mortality, therefore, of uncomplicated typhoid fever in this series being less than 1 per cent."

There are, I believe, rare instances in which it is reasonable to suppose that conditions other than anatomical ones exert some influence upon the escape of blood from the bloodvessels. In this connection, I will report a case in which the hemorrhages were stopped by a mental impression:

A child of about twelve years, a patient of Dr. Ogden's, was suffering from typhoid fever with profuse hemorrhages from the lungs, stomach, fauces, nose, mouth, bladder and bowels. If the hemorrhages had continued, the amount of blood lost would have been sufficient to kill the patient in a few hours. We gave an unfavorable prognosis to the child's mother; and, with tears in her eyes, she went into the room in which her daughter was lying. In a whisper, the child said: "Did the doctor say that I am going to die? Don't cry, mother, and I will get well." In a short time the blood began to flow less freely, and in about eight hours it had entirely ceased.

To show how other hemorrhages than those of typhoid fever may be arrested by emotion, I will cite the following:

A woman with chronic phthisis was seized one morning with a profuse hemorrhage from the lungs. In the latter part of the afternoon she was taken upstairs to her room, and a fire was kindled in a stove in which her son had previously concealed a quantity of gun-

powder. An explosion ensued, destroying the stove. The greatest solicitude was, after this, felt for the patient; but it was found that the bleeding had been summarily arrested by the shock of the explosion.

I will also read the report of a case in which emotion caused a hemorrhage from the lungs, in which there was no ulceration:

A woman having a small phthisical area at the right apex,—as shown by bronchial breathing, impaired resonance, progressive emaciation and slight cough, was shocked, one day, by seeing an undertaker's wagon draw up in front of her house. Supposing that the wagon contained the body of her husband, she was immediately seized with a profuse hemorrhage and died in a few minutes. The corpse that had occasioned her alarm had, by mistake, been driven up in front of the wrong door, being the body of a man who had resided in the next house. At the autopsy on the body of the woman, it was found that the lungs were merely indurated, and that the breaking-down process had not commenced.

These cases serve to show that mental shocks may favorably or unfavorably influence persons who have anatomical lesions from which hemorrhages are liable to take place.

Pathology.—The erosion of a bloodvessel in the intestinal canal is caused by the process of ulceration that is going on inside the bowel and the bloodvessels may be so eroded or weakened as to allow of rupture; hence, the outpour of blood. The hemorrhage usually takes place after the end of the second week, at which time the sloughing process begins. It may, however, occur later; or, in some rare instances, earlier. When the bleeding is due to the hemorrhagic diathesis, this fact may account for some of the very early hemorrhages. In some instances it is difficult to mark the commencement of the initial stage of the disease; hence, although the patient may be considered to be in only the first or second week of the attack, he may really be in the second or third.

As a general thing, the blood is not passed when it leaks out of the bloodvessels, but is retained—for a short time, when the bowels are loose, and for a longer period if the patient is constipated. The bleeding may be over when the blood is discovered. The period that elapses between the time of the hemorrhage and that of its expulsion from the bowel makes a great difference in the appearance of the blood. When it is expelled promptly, it may be arterial in color.

When it is retained but a short time, it becomes clotted and bluish, though red in places on the surface, the latter color being due to the blood's having become aerated through standing in the open vessel. When the blood is retained for a long period in contact with the intestinal juices, it becomes dark and tarry in appearance and consistency.

There is one class of cases of which I have seen but four instances; this is the petechial form of typhoid fever. In this form we have ecchymotic spots over the whole body and extremities, hematuria, epistaxis, hematemesis, hemoptysis—in fact, we may have hemorrhage from all the mucous surfaces. In one such case I have seen bleeding from the eyes and ears. Two out of the four cases recovered.

Diagnosis.—The first requisite is to have on guard some one competent to advise the physician as to the advent of the complication. I once had a nurse who, when I entered the sick-room, pointed with pride to the subnormal temperature and remarked that the patient was doing unusually well; when, in fact, he was suffering from the effect of a concealed hemorrhage.

The statistics that I have collected show that when the hemorrhage is slight, it has little or no influence upon the temperature or upon the strength of the patient; hence, we are called upon to diagnose such cases by the observation of other points than the general symptoms. When the blood is retained in the intestinal canal, the patient—as in one of my cases—may die without the external escape of a single drop of blood, but with all the evidences of an internal hemorrhage. The symptoms in the case mentioned were those of collapse—a rapidly failing pulse, relaxation of the skin, a cyanosed surface, an anxious expression of the face and a gasping for breath—the abdomen, at the same time, being distended and perfectly flat on percussion.

Many mild cases were omitted from this report, on account of a doubt as to whether they were hemorrhoidal or were instances of typhoid hemorrhage from ulcerated glands in the intestines. In one instance, a case was diagnosed by the resident physician as one of hemorrhage from the bowels, and was put upon a treatment appropriate to such an accident; upon careful examination, however, it was discovered to be a case in which the menses had been hastened by the bowel irritation. This case illustrates the liability to error in diag-

nosing mild cases of enteric fever with hemorrhage, from hemorrhoidal bleeding or from menstrual flow.

There is one point to which I should like to call your attention: Very often, after a fall in the temperature and a subsequent rise, the bowels are moved and a considerable quantity of pure blood is passed; but the treatment then instituted is frequently such as to check the action of the bowels. The next time the patient has a passage—perhaps twelve or twenty-four hours later—there is evacuated some dark or tarry blood. This is generally looked upon as indicating a second hemorrhage; while, in reality, the general symptoms and the temperature go to show that the blood was all poured into the bowel at the same time, the second evacuation consisting of the portion that was retained in the bowel owing to the treatment's having stopped the bowel-action after the first portion was passed.

When the hemorrhage ceases, the temperature usually rises again nearly to the point at which it was before the bleeding took place; in some cases, even higher, owing to the reaction from the excessive loss of blood. The amount of blood lost can generally be easily estimated by the fall in the temperature, the exsanguined appearance of the patient and the prostration produced.

Prognosis.—During the last twenty-five years I have carefully tabulated all the cases of marked hemorrhage from the bowel in typhoid fever that I have seen in my own practice and in consultation, most of these occurring in the Presbyterian and Philadelphia Hospitals, and some that occurred in St. Timothy's. In the one hundred cases tabulated, eighty have been taken from hospitals; the remaining twenty, from private practice. In those taken from the hospitals the mortality is much greater than it naturally should be, owing to the fact that many cases first treated outside are sent to a hospital on account of the dangerous condition of the patient, and are sometimes admitted in a moribund state. Some of these cases were brought to my notice through their having proved fatal. The hospitals from which I have gathered the statistics receive mostly adults; hence, my statistics include but few cases in childhood.

From the experience that I have had with this class of cases, I am satisfied that those with the most severe symptoms sometimes recover. This is well shown by the case of the little girl already referred to. This child had typhoid fever and general hemorrhages; but, when it was supposed that death was quite near, she speedily recovered.

Another instance of the same kind is afforded by a case that I saw with Dr. J. Howard Evans. A boy of about eight years had had, for about twenty-four hours, hemorrhages from the bowels in which an almost continuous stream of dark, clotted blood was passed. He was almost pulseless, quite exsanguined and in a state of collapse; but, under treatment, his recovery was quite rapid. In one case seen in the University Hospital in 1876, a man was apparently bleeding to death; but an injection of ergotin seemed at once to staunch the flow. He then slowly returned to health; yet no one who saw the patient had any idea that he could recover.

The associated conditions that seem to be the most serious in severe cases of hemorrhage are the following:

(1) Renal disease, which sometimes alters the blood, in some cases rendering it less coagulable and thus favoring hemorrhage from all points.

(2) Marked organic heart disease, in which the blood, being impoverished and lessened in quantity, is propelled slowly, causing the tissues to be only imperfectly supplied with blood. Under these circumstances, a hemorrhage from the bowel becomes a most grave complication.

(3) Hemophilia, in which the blood becomes so altered that there is little likelihood of the hemorrhage's being staunched and much liability to other hemorrhages.

(4) A tympanitic distention of the abdomen with the continual discharge of black, clotted blood, which is a very serious condition, as the bloodvessels are kept patulous by the distention of the intestines; or the latter and the bloodvessels have both lost their contractile power, thus favoring relaxation, not only of the bowel, but also of the walls of the bloodvessels. I always dislike to see this condition in hemorrhage from the bowels.

(5) Obstinate diarrhea and vomiting, which are decidedly unfavorable to the staunching of the blood.

Treatment.—I have found the usual remedies for hemorrhage from the bowels to be of more or less value. If the hemorrhage is caused by a leakage from the mucous membrane, ergot—both hypodermically and by the mouth—is efficacious.

I have great faith in turpentine, externally and internally. In cases in which the hemorrhage is associated with tympanites, it is especially good. In applying it externally, I prefer to have it

sprinkled upon a piece of flannel. This is, I think, better than the stupe, which, by producing warmth, favors bleeding.

Opium is of great importance when the bowels are inclined to be loose.

In cases in which the stomach will bear it, oil of erigeron, given in a capsule, does have a seemingly good influence. The vegetable and mineral astringents may do good in the same class of cases; but they also are liable to disorder the stomach and take away the appetite, especially after the hemorrhage has been stopped.

Ice applied to the abdomen externally or pieces of rounded ice slipped into the bowel, seem to have some efficacy in retarding the flow of blood, but it is essential that the impression made upon the blood-vessels be continuous, and not intermittent. In applying the ice externally, an ice-water bag, or some other receptacle that will keep the patient from becoming wet, should be employed.

During the last two years I have seen the advantage to be derived from the use of suprarenal extract in cases in which there is general hemorrhage. A colored man in the Presbyterian Hospital had marked epistaxis, a persistent flow of blood from the bowels and the vomiting of blood; and all remedies seemed to fail, until he was placed upon this remedy. In the course of eight or ten hours the blood began to diminish in quantity, and in twenty-four the patient stopped bleeding altogether. He made a good recovery. In some severe cases I have also tried thyroid extract, with apparently good results.

The head of the patient should be kept lower than the feet. This can be accomplished by raising the foot of the bed.

In extreme cases, I have seen the efficacy of placing ligatures around the limbs during the hemorrhage. These prevent the blood's flowing back from the limbs to the body; favor the staunching of the blood; and, at the same time, save that fluid for the future use of the patient. They should not be so tight as to prevent the flow of blood in the arteries, but should be tight enough to stop the return of the blood in the veins.

I will here quote from a paper read by me before the American Medical Association in June, 1897, on the statistics of sixty cases—nearly all that I had collected up to that time:

"I published a clinical lecture in the Philadelphia Hospital Reports in 1893, giving statistics of the first seventeen cases that I had gathered at that time. Of this series, five died and twelve recovered;

seven were treated at their homes, and ten in the hospital; and of the five deaths, but two were private cases.

"In the last series of forty-three cases, the mortality has increased, twenty-three having died, while twenty recovered. In five private cases, two died; and of the hospital cases, twenty-one died and seventeen recovered, making the mortality over one-half. What is the cause of this increased mortality?

"These later cases have been collected since the introduction of the cold-water treatment, which is used quite generally in the hospitals from which the cases were taken. In the private cases, cold-sponging was resorted to in every instance reported in the last series.

"Upon investigation, I found that since the cold-water treatment has been introduced the number of hemorrhagic cases has considerably increased, according to the hospital-records that furnished the data; and, in addition, that the mortality of the hemorrhagic cases has largely increased—viz, from five in seventeen, or less than one-third, to twenty-five in forty-three, or over one-half.

"Let us see what is the effect following the free use of cold to the surface, which is so universal in the hospitals. When you take into consideration that the application of cold drives the blood from the surface of the body, you will realize that an increased amount of blood will collect in the interior, causing a congested condition of the internal organs. If there happens to be a bloodvessel weakened or opened by the suppurative process, it may give way; or a clot may be dislodged and a hemorrhage follow. The disturbance necessary in giving a cold bath or the reaction following such a bath may have a tendency to produce the same result. On inquiry, I find that in two of the tabulated cases the hemorrhage seemingly took place while the patient was in a bath, and in one case immediately after the bath. One hemorrhage occurred while the patient was in a cold pack, and two just after a cold sponge.

"These statistics seem to indicate that it would be well to avoid cold applications to the skin when there is a tendency to hemorrhage or when this has already occurred. I would also suggest that during the third week, when the sloughing process is the most active, the cold bath or pack, if used at all, be employed with great care, avoiding sudden and marked impressions upon the external circulation. In this way, we may avoid making the case a hemorrhagic one."

My series of tabulated cases has reached nearly one hundred. In

the near future I hope to be able to present some facts in regard to them that may be of value in the management of this interesting complication of a too prevalent disease.

The Significance of Abdominal Pain in Typhoid Fever.

BY HERMAN B. ALLYN, M. D.

In a large number of cases, two-fifths of the patients, according to McCrae,¹ typhoid fever runs its course without abdominal pain or tenderness. We should err, therefore, if we looked upon pain as a symptom so constant as not to need special attention. The causes of the pain met with in typhoid fever may for convenience be divided into extra-abdominal and abdominal. To the former division belong the cases of hysteria and general hyperesthesia, in which there is often great complaint of pain and tenderness. They are usually easily recognized. Here belong also cases of pleurisy, empyema and pneumonia, with marked abdominal pain. They are very interesting, but there is only time to mention them now.

Of the abdominal causes, some, such as distended bladder, menstruation, abortion and labor, have nothing to do with the specific fever, and need only be kept in mind to be recognized in a concrete example at the bedside. The remaining causes are the most important. They are intestinal colic and distention of the bowel with gas; enterocolitis; deep ulceration so that the serosa is involved; phlebitis of an abdominal vein; coincident appendicitis; ileus; peritonitis without rupture; cholecystitis and liver abscess; hemorrhage and perforation.

Colic and Distention.—Pain from simple colic and distention can be recognized by the presence in the stomach or bowel of gas, the escape of which relieves the pain; by the history showing the ingestion of improper food, or by the passage of curds or other undigested food in the stools. The pain is usually general over the abdomen, or moves from place to place; it is not accompanied with tenderness but is relieved by pressure. It has little effect on pulse and temperature. Vomiting is not common in simple colic, the attack usually lasts only a few hours and the pain is not so severe as to make the patient cry out. The aspect of the patient does not suggest great suffering. The bowels are often constipated and the abdomen distended with gas. A

free movement of the bowels or the escape of gas through a rectal tube may end the attack.

Enterocolitis.—In enterocolitis pain is usually accompanied with some soreness, but both are of a dull character and are diffused, not localized as in perforation, cholecystitis or appendicitis. The stools are frequent, loose and often contain undigested food, shreds of mucus and even flecks of blood. The abdomen may be distended or flaccid. Pulse and temperature are not much affected. These are just the cases, however, in which at any time either hemorrhage or perforation may occur.

Deep Ulceration.—Intestinal ulceration is not necessarily attended with pain. We have all seen cases at autopsy in which the bowel showed extensive ulceration, and have been surprised that no pain was complained of by the patient. This has been my experience both in typhoid fever and in amebic dysentery. But in general when the ulcers are numerous, and especially if they be deep, pain is likely to be present and tenderness on pressure still more to be expected. If the ulceration is deep enough to involve the serosa, the pain may be sharp and severe enough to simulate the pain of perforation; otherwise the pain is dull. In a case operated on under cocaine by Mitchell, and reported by McCrae, great pain was complained of when the serosa over the base of an inflamed Peyer's patch was touched. This did not, however, occur in other cases. Appendicitis was also present. It is certain that pain, tenderness, tympany and diarrhea bear no constant relation to the extent of ulceration.

Phlebitis of the Iliac Veins.—This can only be diagnosed when abdominal pain follows phlebitis of the leg. I have seen such a case. Possibly, as in Case XXVI reported by McCrae and Mitchell,² there may be tenderness along the iliac veins.

Appendicitis.—Appendicitis may occur as a complication of typhoid fever and be responsible for the pain. McCrae and Mitchell report a case which was operated on and ended in recovery. There was no evidence that the appendicitis was due to the typhoid process. The only organisms obtained from the appendix were bacillus subtilis and saprophytes. Fitz found that perforation was in the appendix in 3 per cent. of 167 cases; and one of Gairdner's forty-seven cases had a perforation in the appendix. Perforation of the appendix alone occurred in three of the 112 operative cases collected by Finney.³ In the Johns Hopkins Hospital twenty cases (pathological records), per-

forations of the appendix were found in two cases; and Cushing⁴ says he knows of one more in a group of nine cases, which makes perforation of the appendix occur in 9.6 per cent. of the cases showing perforation. Possibly the inflamed appendix could be felt by a finger introduced into the rectum. Otherwise, I can see no way in which an appendicitis occurring in typhoid fever could be differentiated from the peritonitis of perforation.

Ileus.—Obstruction of the bowels occasionally occurs in typhoid fever. Curschmann refers to cases, Cushing⁴ has met with it in an operative case and refers to cases of Harrison and Barte. The symptoms are mistaken for those of perforation, but leukocytosis appears to be much greater.

Septic Peritonitis without Perforation.—This may occur when there are necrosed and damaged areas of peritoneum over the bases of the ulcers. Such cases have been reported by Gairdner and by Shattuck, Warren and Cobb.⁵ It may be that in rare cases bacteria pass through the bowel when there is an ulcer down to the serosa, and thus excite peritonitis. The authors just quoted report two cases in which a beginning general peritonitis, as evidenced by gas and serous fluid in the abdominal cavity, was found at operation, but the peritoneal coat was not injected. They also report a case of peritonitis due to necrosis and rupture of a mesenteric gland. In such cases there would be the pain and other symptoms due to peritonitis, but the cause could not be discovered except at operation or autopsy.

Cholecystitis and Liver Abscess.—Cholecystitis is fairly common in typhoid fever, and a few cases of liver abscess have been reported. Cases and literature will be found in the papers of Osler,⁶ Mason,⁷ Da Costa,⁸ the monographs of Keen⁹ and Hare,¹⁰ and the article of Camac.¹¹ The onset of cholecystitis is marked by pain in the upper right quadrant of the abdomen, tenderness on pressure beneath the right costal border or in a line between the tenth rib and the umbilicus, and some muscular rigidity. In the three cases I have seen, the attack occurred in convalescence.

CASE I. *Mild typhoid fever with cholecystitis. Recovery without operation.* A young woman had a mild but undoubted typhoid, lasting about 3 weeks. After the temperature had declined to normal it was often a fifth of a degree above normal without obvious cause. On November 5, 1901, the temperature was 99.4°. She had a feeling of fulness and tension around the abdomen on a level with the stomach, but did not mention it until later. After midnight she developed severe pain in the epigastrium, perhaps a little more

marked to the right and in the right axilla and back. The pain increased in severity in spite of emptying the stomach and external applications. Morphine was required twice at 3 and 4.30 A. M. There was some nausea, no tympany, abdominal tenderness, shock or diminution of liver flatness. The temperature rose to 102° + and the leukocytes from 4,000 to 19,000. When seen November 6, she looked ill, with frequent, small, rather hard pulse, 120 per minute. There were dark circles under the eyes. No tympany or abdominal tenderness. Nothing was discovered by rectal examination except slight tenderness on pressure a little to the right of the os uteri. There was no mass and no fixation of the uterus. Some hardened feces were felt in the rectum and descending colon. The conjunctivæ were slightly yellow. The bowels were freely opened with salines. At 9 P. M. the temperature had fallen slightly, and the leukocyte count was 11,000. The heart, pleura and lungs were normal. The patient slept well. The next morning, November 7, the temperature was 99° . Then for the first time, a movable, rather hard tumor, the size of a duck egg, was felt just above the umbilicus. It descended on full inspiration, was dull on deep percussion, but liver flatness was not continuous with it. The eyeballs were slightly more yellow. There was no vomiting, but slight nausea. The temperature ranged between 99° and 100° for a few days, and then fell to normal. There was no recurrence of pain. Tenderness was not pronounced and gradually subsided. On some days the gall bladder could be distinctly felt and its connection with the liver made out, on others it could not be felt.

CASE II. *Relapse in typhoid with cholecystitis.* E. S., male, aged 45 years, when 10 days convalescent from typhoid fever, ate heartily of a Christmas dinner. Two hours later he was seized with severe pain beneath the right scapula and began vomiting. That night he had a severe chill so that he shook the bed. The following morning the temperature was 104.4° , the pulse 93. The pain was now over the upper zone of the abdomen, though the region of the appendix was tender on deep pressure. The abdomen was rigid, especially on the right side. By the following morning the bowels had moved twice. The temperature was 101.8° , pulse 94. There had been no vomiting or chill. There was a tender mass in the abdomen beneath the liver and above the transverse umbilical line. For several days following the temperature rose in the evening to 104° or 105° , and he had chills and vomiting. The blood twice yielded the Widal reaction. The mass in the abdomen was irregular, hard, nodular and tender to pressure. It remained nearly stationary in size for 2 weeks. He recovered without operation.

CASE III. *Cholecystitis in convalescence from typhoid fever.* M. C., female, white, 33 years old, was admitted to the Philadelphia Hospital, August 15, 1901. There was a history of 5 weeks illness before admission, characterized by chills, fever, sweats, diarrhea and vomiting. She is believed to have been ill with typhoid fever about 5 days when admitted, as the first Widal was negative. The Widal reaction was positive first on August 19. The patient reacted badly to tub baths. On August 25, she had collapse, followed by the appearance of blood in the stools. Her convalescence was interrupted by several recrudescences. On September 17, the leukocytes were

5,000. She had dull, aching, epigastric pain during the night of the 17th, and early morning of the 18th, and vomited. On the 18th she was seized with severe pain in the precordium and right hypochondrium. The pain was griping and darting, causing acute agony. Ice bags locally and morphine internally relieved the pain. She had a chill at 10 A. M., followed by rapid rise of temperature to 105°. The chill lasted ten minutes. No malarial organisms were found. After the chill the leukocytes rose to 15,000. The tongue was dry, the skin a pale brown, the conjunctivæ slightly icteroid. There was tenderness in the epigastrium and right hypochondrium. The liver extended 2 cm. below the costal border. The pain did not recur during the day, but the patient vomited at 11 A. M. At 4 P. M. the leukocytes were 7,000. She complained of griping, colicky pain in the abdomen about the umbilicus. There was tenderness in the epigastrium. A vaginal and rectal examination was negative. The temperature fell to normal on the 19th, then rose to 101° and gradually sank again to normal in a week.

McCrae and Mitchell report five cases of cholecystitis. The picture presented by cholecystitis is that of a patient seized with severe pain in the right upper quadrant of the abdomen, the pain often requiring anodynes and being accompanied with a varying degree of tenderness and muscular rigidity. The temperature rises sharply to 100°-104°. A moderate leukocytosis is the rule. Vomiting is common, and there may also be chill. Jaundice was present in two of my cases and in one reported by McCrae and Mitchell. A demonstrable tumor is more frequently absent than present. It was felt in only one of McCrae and Mitchell's cases and in two of mine. In two of their cases and in all of mine it occurred in convalescence or in relapse; and this, it seems to me, is a point of value in the diagnosis. Possibly many of the cases showing recrudescence are mild gall bladder infections. I recall the case of a boy, aged eighteen years, who had typhoid fever twenty-eight days before the temperature became normal. The following day it began to rise until at 6 P. M. it was 104°. He complained of some soreness and pain in the right side of the abdomen below the liver and above the region of the appendix. A small lump, about the size of a hickory nut could be felt; it was tender to pressure; it did not move with respiration; subsequently, he had a chill and nausea, which increased, and he vomited undigested milk. After a few days the tenderness became localized to the region of the appendix which was slightly enlarged.

We are accustomed to ascribe these attacks in convalescence to undigested food. But it seems to me unreasonable to think that so sharp a febrile reaction is due to nothing more serious. The greatest

difficulty I have had is in deciding between cholecystitis and appendicitis.

When the gall bladder ruptures, the symptoms are those of perforative peritonitis, several instances of which have been reported. The writer has elsewhere¹² published a case in which there were perforations of the gall bladder and colon. A few cases of liver abscess have been recorded. Most of the cases have been recognized only at autopsy.

Intestinal Hemorrhage.—Intestinal hemorrhage is a cause of pain, but as it has been fully treated by Dr. Curtin it is only mentioned here to make the list of causes complete.

Perforation of the Bowel.—This is the most serious and important of the painful abdominal complications of typhoid fever. Shattuck, Warren and Cobb report seventeen cases, and McCrae and Mitchell, in a paper which has appeared while this article was in preparation, report eight cases in a series of 275 occurring in Dr. Osler's service in the past two years. All of these twenty-five cases were operated on. It is painfully evident from a study of them that no symptoms and physical signs invariably indicate perforation. While sudden severe abdominal pain in the lower abdomen, accompanied with tenderness, rigidity, drawing up of the knees, distention, nausea and vomiting, sweating, a fall or an increase in temperature, a more frequent and feebler pulse, movable dulness in the flanks and leukocytosis, indicate pretty certainly a perforation, such a combination of symptoms is rarely met with; and if it were it would point to an existing peritonitis rather than to the perforation which preceded and caused it.

Premonitory Symptoms.—We need more information as to the premonitory symptoms of perforation, and a keener appreciation of pain as the only constant symptom of the onset of perforation. In my own experience perforation has occurred in severe cases which have been characterized by loose bowels, distention or hemorrhage. But in eighteen of the twenty-four cases reported by Shattuck, Warren and Cobb, the clinical nature and course of the typhoid was mild, and in fifteen of these eighteen mild cases perforation or a general septic peritonitis was present at operation. In some cases varying degrees of abdominal pain and tenderness precede the perforation, and when coupled with distention or blood in the stools should lead to hourly visits to the patient. A leukocytosis may also be found at this time. But a leukocytosis is found in so many cases that not much value can

be attached to it by itself. In seven of the twenty-one cases reported by Shattuck, Warren and Cobb, there were no warning symptoms before perforation; in fourteen there were distinct warning symptoms of abdominal pain and tenderness. In the cases of McCrae and Mitchell, four of the eight cases presented no abdominal features before perforation; three patients had distention, rigidity and abdominal pain, in two instances accompanied by leukocytosis. In one case there was intestinal hemorrhage one day before perforation.

Onset.—Abdominal pain, tenderness and muscular rigidity are the only constant symptoms indicating perforation. The other symptoms already mentioned should be regarded as symptoms of the resulting peritonitis. The pain is sudden, sharp and often severe enough to cause an outcry from the patient. Such pain strongly suggests perforation, whether premonitory symptoms have occurred or not. The probability of perforation is greater if the pain has come on at or soon after a stool or tub bath. The pain is usually in the lower abdomen, and often in the right lower quadrant. Following the pain and tenderness there may be some shock, sweating or collapse, but these are not constant symptoms, and collapse is more common in hemorrhage. The temperature may fall, and then usually rises again. In the cases of crisis which simulate perforation, the temperature falls to normal and remains down, as in one of my cases. The pulse becomes more frequent and feeble, the abdomen may be distended, level or retracted, but the liver flatness is diminished or absent. By degrees, if the patient survive long enough, the well-known facies of peritonitis appears.

Leukocytosis demands special consideration. As the leukocytes in typhoid fever are normally low, 4,000 to 6,000, an increase points to a complication, but affords very little clue to the nature of the complication. It may be absent in perforation at the time the blood is counted. Of the cases reported by Shattuck, Warren and Cobb, in eight a leukocyte count is recorded at a time corresponding to the severe symptoms of peritoneal infection, and in four of these there was no leukocytosis. In the eight cases reported by McCrae and Mitchell, in three there was practically no change in the leukocytes after perforation. In one of these the leukocytes were normal throughout, and in the remaining two there had been leukocytosis previous to the perforation which did not change appreciably. In five cases the leukocytes rose in varying degrees after perforation. They regard it

as significant that the two cases showing the greatest rise in leukocytes after perforation were those in which hemorrhage and perforation coexisted. The leukocytes in these cases were 14,000 and 17,500. In the remaining three cases the highest leukocyte counts were between 8,000 and 12,000. Evidently we must not expect to find a leukocytosis in every case of perforation. As Cushing has pointed out, an early increase in the number of leukocytes may be succeeded by a fall, and it depends upon when the count is made what result is obtained. While I should not attach much importance to a single count, nevertheless I believe that frequent counts by a skillful and conscientious man are of considerable value.

We must realize, moreover, that leukocytosis and other more important symptoms of perforation are present in some rare cases in which perforation does not exist, or at least in cases which end in recovery without operation. Here is a case of that kind:

CASE IV. *Typhoid fever with hemorrhage and abdominal pain indicating perforation; recovery without operation.* M. L., white, 16 years old, Russian, admitted to the Philadelphia Hospital August 30, 1901, complaining of fever. He is supposed to have been ill about 14 days before admission. His symptoms previous to admission were headache, chill, vomiting and pain in the stomach and diarrhea. On admission, his temperature was 104.8°, pulse 110, respiration 26. His abdomen was flat, and tender in the right iliac region. There was slight bronchitis. Rose spots were found on the abdomen. The Widal reaction was obtained. The leukocytes were 6,000. He became too chilled by tub baths at 60° and they were stopped. The bowels continued loose, the stools being greenish and offensive in odor. On September 3, he complained of sharp pain in the abdomen and passed 10 ounces of blood. There was no shock or collapse. Food and medicine were discontinued by the mouth. Two days later he had sudden, acute, abdominal pain referred to the right lower quadrant and to the umbilicus. The pulse was 120, the abdomen slightly tender. The temperature fell gradually to normal by the morning of the seventh without collapse. There was some rigidity of the right side of the abdomen, on the sixth, the abdomen being flat; it was very tender; the pulse was frequent and wiry; pupils moderately dilated; leukocytes 18,000. On the seventh the leukocytes were 14,000. The patient was, however, restless, face drawn and anxious, pupils dilated, pulse continued frequent, small and wiry. The abdomen became more distended, tenderness increased over the right lower quadrant, the percussion note was impaired and more resistant, digital examination of the rectum developed increased resistance on the right side; the patient vomited a greenish-yellow material. The bowels had not moved and no gas passed. The aspect of the patient was bad. He was stuporous, the tongue was dry, glazed and cracked. He was very restless at night. Nevertheless, in spite of such grave symptoms, the temperature remained down, and the patient gradually improved and finally convalesced.

I advised operation in this case on September 5, after the severe abdominal pain following the hemorrhage of September 3. The surgeon who saw the patient was not satisfied that the symptoms indicated perforation and declined to operate. I feel confident, however, that more patients presenting such symptoms will be saved by prompt operation than by expectant treatment. At the same time, the case shows that one should not be dogmatic, for all signs fail at times. It is the ignorant man, and the one who does not make notes of his cases, who is always sure he is right.

The following case is reported as an instance of typhoid fever with perforation which was obscured by the hebetude and toxemic state of the patient.

CASE V. Typhoid fever, with marked hebetude and toxemia; sudden collapse nine days after admission; death in five hours. T. M., white, male, 45 years old, was admitted to the Philadelphia Hospital September 8, 1901, with a history of three weeks' illness characterized by chills every second or third day; vomiting, anorexia, loss of flesh, vertigo, offensive breath. He was a poorly nourished, rather pale, spare man, with hebetude and some tremor of the muscles about the mouth and of the tongue. The heart sounds were weak, the lungs not diseased. Plasmodia of malaria were looked for repeatedly but not found. Both Widal and diazo were positive. The leukocytes on the eleventh were 6,648. He showed marked toxemia. The fever was continuous. There was constant twitching of the muscles, hebetude and delirium. There was also severe nephritis. The temperature ranged from 102° to 104° and was reduced by spongings instead of tub baths owing to his feeble condition. Subsequently he developed severe congestion of both lungs and incontinence of urine. The abdomen was distended. On September 17 the patient was found in collapse, of which there had been no warning symptoms. There was no pain to attract attention, no variation in temperature. He was found sweating freely at 5 A. M. The abdomen was rigid and tender and beset with small vesicles. The distention increased and there was diminution of liver dulness. He died suddenly at 10 A. M., 5 hours after he was found in collapse. At the autopsy, perforation of a typhoid ulcer was found about a foot from the ileocecal valve. There were no limiting adhesions. Some free fecal matter was found in the peritoneal cavity.

I am well aware that there are other causes of abdominal pain of which as yet we know almost nothing. I am also painfully conscious that I have not done justice to those causes which have been referred to in this paper. The subject is so important, however, that its introduction and discussion must result in benefit to our patients. I wish to insist that pain and tenderness are not necessary accompaniments of

typhoid fever; on the contrary, they may be signs denoting the approach or the actual onset of a cholecystitis or perforation of the bowel. Pain is, therefore, a danger signal. It should lead to a more careful study of the case, to more frequent visits, the observations being recorded in writing; and when there is reason to suspect cholecystitis, perforation or peritonitis, a surgeon should have the opportunity to see the patient early and often. Only in this way can the unfortunate patient with a perforating typhoid ulcer be numbered among the 25 per cent. saved by surgical interference.

With regard to cholecystitis, also, I believe that in most cases it is safer to have surgical advice. My own cases have recovered without operation, but the next patient may die of a perforating ulcer which has given no warning symptoms.

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The Diet in Typhoid Fever.

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When first invited to participate in this symposium on typhoid fever, I had some hesitation in accepting, though fully cognizant and appreciative of the privilege extended to me, merely because I felt there may be those who would question the value of any contribution, unless supported by an array of clinical evidence, solidly marshalled into line. This I am unable to do in massive form, since I have to record cases seen only in private practice, but as I wish especially to call attention to the unnecessary restriction of food commonly practiced, hospital records would not be likely to serve my purpose. Indeed, the dietetic management of typhoid cases is universally so similar, that as a matter of fact, comparatively little has been written advocating a departure from traditional lines, and still fewer statistical reports have been published. Curschmann¹ says there are few points

in the management of typhoid in which such unanimity exists. This would seem at first sight to argue against the more liberal plan herein advocated, but it is only necessary to advert to the dictum of Graves and the time necessary to bring about its general acceptance, to prove that an almost unanimous opinion is not necessarily correct. Then too, we know to-day that typhoid fever is a general infection in which the bowel lesion is but an incident and may be entirely wanting.

Two difficulties confront us in the dietetic management of a typhoid case: first, the exhausting fever; and second, the state of the bowel, and while it is generally recognized that the former must be combatted, the second refuses to down, like Banquo's ghost.

As to the feeding of fevers in general there is no longer any difference of opinion, but in typhoid it is assumed, on no very good grounds, that the digestive functions in general are lowered far more than in any other condition, this possibly is in part due to the length of the attack with its attendant toxemia, and in part to lack of stimulation due to lessened desire for foods. However, in no other lasting febrile condition do we deem it necessary to restrict the diet to such an extreme degree, and as a matter of fact, forced feeding is often resorted to. It is only just to add that the majority of observers restrict the diet rather from a fear of producing hemorrhage and perforation, than on account of lowered digestive function.

Concerning the diminished desire for food, more is to be said. As is well known it is by no means constant, though usually very little desire for food is manifested, but as Rabelais has said, "*L'appetit vient en mangeant.*" The work of Pavlov² and his pupils affords abundant evidence in this direction, and justifies a rather extended notice. Borissof in the last volume of *International Clinics*, gives a résumé of the work emanating from Pavlov's laboratory. One of the most interesting facts determined, and one having a relation to the subject under discussion, is the so-called psychical secretion of the digestive glands.

He proceeded by making a fistula in the stomach of a dog. Later the esophagus was divided and the cut ends sutured to the wound. Thus when the dog is fed, the food falls from the upper opening, and though nothing reaches the stomach, secretion of gastric juice begins in from five to six minutes. It will begin in the same time, though less juice is secreted, even when food is merely shown to the animal. If small stones be given instead of food, no secretion will follow the attempt to masticate and swallow, showing that "chewing

and deglutition are not the fundamental factors in this secretion." Then too, with each kind of food a definite secretion of specific composition results. Beside the psychical secretion a purely chemical secretion also was found. It was formerly taught that mechanical irritation sufficed to cause gastric secretion, but Pavlof has shown this to be fallacious. Continued irritation with a glass rod, feather or sand failed to produce a drop of secretion. If to a dog with a gastric fistula, fresh meat be given without allowing him to see it, Lobasoff found that in two hours but 6.5 per cent. had been digested. If now a dog be tantalized by showing him meat for a few minutes and the meat then be placed in the stomach, 31.6 per cent. was digested in two hours. Thus we see the psychical influence upon digestion.

So too, with the salivary glands, Pavlof has been able to show that psychical stimulation takes place, the secretion varying with the character of the stimulus, so that the oral cavity is thereby prepared for the reception of food prior to its actual administration.

For instance, if small clean stones be given a dog no secretion results, even though he attempt to masticate them. If sand be placed in the mouth there will be a free secretion of watery saliva, while a weak acid will give rise to a turbid, highly albuminous saliva.

Raw meat causes no parotid secretion, and but a small amount of thick saliva from the submaxillary gland. Dried powdered meat or dry biscuit causes large quantities of parotid secretion. This latter, therefore, does not depend on appetite or need for mastication, but on the dryness of the food. With the submaxillary glands, food gives rise to a thick secretion as if to lubricate it and facilitate its passage to the stomach. It is thus seen that saliva moistens the food, rinses the mouth, dilutes injurious substances and to some extent neutralizes them. This can be brought about by psychical means only, for as already stated, precisely the same result follows when an animal to whom the various substances have been given on some previous occasion, is merely shown them. The pancreatic juice was shown to be intimately influenced by gastric secretion. The lesson to be drawn is, that if the desire for food can be brought about, and this is more likely the case when a variety of food is allowed, psychical stimulation will aid in preparing the digestive organs for the reception of food, and digestion will thus be more rapid and thorough than in those cases to which merely milk and broths are allowed, for these pall on one, and thus the very important psychical stimulation is totally

lacking. Further, as has been said, each food gives rise to a definite secretion of specific composition, best suited, therefore, to the immediate needs of the case, and even granting that the digestive power is lowered, it will be less so when the blood and tissues are supplied with a rich source of energy from which to draw, than when merely a milk and broth diet is allowed.

The second difficulty is the bowel lesion. The clinical phenomena bear no relation to the morbid anatomical state of the bowel. An extremely mild and ambulatory case may have severe and deep ulceration, while a profoundly toxic one may have none. Nor is it possible to judge of the degree of ulceration by the number or character of the stools. Diarrhea may be present in the entire absence of ulceration or constipation may predominate when extensive ulceration of the bowel exists. We see then that the indication is to administer a nutritious diet to overcome the exhaustion and wasting attendant upon the prolonged fever, while, on the other hand, having nothing to guide us, we are fearful of provoking serious mischief in the bowel. But are we justified in our fears? In no other intestinal lesion are we so extremely and uniformly careful to limit the diet to liquids. In the ulceration of tuberculosis, in grave renal lesions accompanied by ulceration of the bowel or in the dysenteries supervision is exercised, of course, but still a wide range of foods is permitted. I am well aware of the different morbid anatomical processes present in the various conditions and of the tendency for the typhoid ulceration rapidly to slough and deepen before an opportunity for the reparative process has been given, but to my mind this is favored rather than retarded, and that by the devitalizing influence of insufficient nourishment.

It is well known that the fever and marked weakness are often prolonged, a so-called inanition or starvation fever is set up, by the limited dietary in vogue, and that improvement immediately follows when the patient is given nutritious food in sufficient quantity. It seems only reasonable therefor to infer, that the marked apathy and exhaustion during the attack are not alone due to the infecting organism and its toxic effects, but more or less to lack of food, both as to quantity and variety, the deficiency thus bringing about a still lower resisting power on the part of the individual attacked. To those who feed their typhoid patients, this amounts to a conviction, for the picture which served to give the disease its name is almost wholly absent. The recovery from any infection is solely due to the greater

resistance of the patient, and that this is more apt to be increased when a variety of food is taken willingly than when an obnoxious diet is given to the individual, is self-evident from what has been said. "We do not so much cure these exanthematous maladies, as keep our patients alive while they are recovering," says Sir Thomas Watson.³

Errors in diet are no longer conceivable as etiological factors in typhoid fever, though Curschmann⁴ believes that they may expedite the invasion in one already infected, and he believes that they may cause recrudescence and relapse. In support of his contention he cites the case of a man, aged forty-three years, who was admitted to hospital on account of anemia, lassitude and weakness. He had no fever, in fact his temperature was a little subnormal. No history of a febrile attack preceding his admission could be obtained. He did not improve but remained pale and weak, and lost one kilogram in weight during eighteen days, in spite of the care bestowed upon him. He was thought to have a tape worm and was successfully treated for it. Three days later the temperature began to mount, and remained up for seventeen days. On account of the temperature curve, splenic enlargement, roseola, thin stools and diazo reaction, the diagnosis of typhoid was made. Curschmann opined that the man had been brought to the hospital during convalescence from ambulatory typhoid, and that the worm cure re-excited the attack. Of course it is conceivable that marked changes in the dietary may cause some fluctuation of temperature, and this in proportion to the dietetic stringency immediately preceding. This is well exemplified in cases of starvation, when it becomes necessary to administer food in small quantities frequently repeated, but no such temperature change is observed in one who has been liberally fed throughout the course of the typhoid attack. Admitted then that some accession of fever may be attendant upon improper or excessive feeding, the same is true, not alone in typhoid, but in any other disease during which the food allowance has been very greatly restricted. That is not a recrudescence however.

It seems more rational to regard both recrudescence and relapse as varieties of the same thing, viz, fresh infection, differing only in that a recrudescence takes place during the decline of the temperature curve, while a relapse occurs after the temperature has fallen to normal and remained so for a greater or less length of time. Osler⁵ regards a relapse as occurring only when after a period of apyrexia, the fever returns and persists for more than a week and in which two

or more prominent symptoms of the disease are present, as the rash, enlarged spleen or gastrointestinal symptoms. Shattuck^e says, "Constipation, nourishment unsuitable in kind or too large in amount, the excitement of a visit or a number of other causes may produce a return or exacerbation of fever; to produce a relapse there must be a re- or autoinfection." I admit that an exacerbation of temperature lasting for a few hours may be due to a variety of causes, but a true recrudescence as well as a relapse, I believe are in reality new infections. Warfield^r in common with most observers of to-day, believes that "a relapse is never caused by external and exciting causes alone, such as sudden emotion, overfeeding, visits of friends, etc., but it is due to a reinfection of the organism with the typhoid bacillus." MacLagan^a and Stewart^a hold that relapses are due to infection of the bowel below, due to sloughs passing along the canal from above, but this need only be mentioned to be dismissed. Durham¹⁰ has advanced a much more tenable hypothesis. He says, "In studying any given infection, we must not look upon it as a result of the action of a number of actually identical infecting individuals, but rather as the result of the action of a sum of a number of infecting agents, each of which is similar but not identical in its nature." He regards all infections as complex, due to varieties and subvarieties of the organisms causing them, and for each he supposes an antibody is formed. When the infective elements are approximately equal, we have a normal or isozymic infection, while unequal ones give rise to an abnormal or anisozymic infection. According to this view, if the antibodies are elaborated in sufficient amount to overcome the different varieties of toxin, recovery occurs without relapse. If, however, several varieties of the infecting organism be present, some of them may predominate and their corresponding antibodies will likewise prevail, though small amounts of the antibodies corresponding to the remaining varieties will exist. Should these latter subgroups now assume an active state, reinfection will take place, often less violent than the original attack, because some of their antibodies are present, and thus is explained the usually milder character and shorter course of a relapse.

My reason for thus emphasizing the different views held with regard to recrudescence and relapse, is to show that food is not responsible for either, and that we should not withhold it, therefore, on such a score.

To demonstrate that the mortality of typhoid fever has not varied

materially, no matter what form of treatment was adopted, I quote from the report of Fitz¹¹ which gives the statistics of cases treated at the Massachusetts General Hospital during seventy-eight years, from 1821 to 1899.

Years.	Mortality.
1829 to 1839	11.8%
1839 to 1849	11.1%
1849 to 1859	16. %
1859 to 1869	15.9%
1869 to 1879	16.6%
1879 to 1889	16. %
1889 to 1899	13.5%

The mortality in the different years varied greatly, being *nil* in 1837 to 40 per cent. in 1868, though by decades it shows a striking similarity. This difference in the annual rate seems to have been due to the character of the prevailing type of the malady, rather than to any modification in the treatment. Up to 1839, emetics, purgatives and blood-letting were resorted to, tartar emetic in doses of one-half to four grains, calomel till the mouth became sore, yet during ten years of such treatment the mortality was only 11.8 per cent. The average mortality for the seventy-eight years, from the opening of the hospital in 1821 was 14.3 per cent., and from the cessation of the heroic treatment in 1839 up to 1899, a period of sixty years, the mortality was 14.7 per cent. From 1839 to 1869 liquid diet only was allowed, the fluids often containing some farinaceous substance. From 1869 to 1879, beef tea, beef juice and milk were permitted, while from 1879 to 1899, the food was chiefly milk. From 1893 to 1898, the patients under the care of Dr. F. C. Shattuck received milk, minced meat, raw and soft boiled eggs, macaroni, soft crackers, toast and puddings. During the thirty years of liquid, farinaceous diet, the average mortality was 14.1 per cent.; on milk and beef tea 16.6 per cent.; and from 1879 to 1899 when milk was the chief article of food, it was 14.6. The mortality among the patients treated by Dr. Shattuck was 11.3 per cent. Intestinal hemorrhage occurred in 159 cases of the 2,767 treated between the years 1849 and 1899, a ratio of 5.7 per cent. This has been much more frequent during the past ten years, than in the preceding decades. From 1893 to 1899, intestinal hemorrhage occurred in 10.6 per cent. of the cases on a milk diet; in 16 per cent. of those on strained proteid and amylaceous fluids; and only in 9 per cent. of the

cases fed on fluids and soft solids. Owing to the obvious difficulty of estimating statistics bearing on the frequency of perforation of the bowel, only cases for the past thirty years were considered. Of those seen from 1869 to 1879, the average frequency was 1.1 per cent.; from 1879 to 1889, 0.3 per cent., and from 1889 to 1899, 1.6 per cent. Relapse occurred in 11.2 per cent. of the cases admitted during the past thirty years. Among those on a milk diet in 13.1 per cent., on strained proteid and amylaceous diet 11.1 per cent., and in those on a diet of fluids and soft solids 10.2 per cent.

Fitz summed up his conclusions as follows: (1) The treatment of typhoid fever does not differ in essentials from the principles laid down in 1839. (2) The average mortality from this disease has not materially changed from the days of active emetics, purgatives, venesection, antimony and calomel, down to the present time. (3) Intestinal hemorrhage, perforation and relapse, upon the whole, are quite as frequent now as at any period in the history of the disease. (4) A considerable variety of diet may be permitted, not only without detriment, but also with possible benefit to the patient.

This last conclusion of Fitz is abundantly confirmed by the result of a comparative study of cases of typhoid fever made by Bushuyev and Sartsievich,¹² the former of whom fed his patients on bread, rolls, farinaceous foods, soft or hard boiled eggs, boiled meat, cutlets, chicken, soups, pudding, jellies, milk, tea and wine. The latter allowed milk, as much as two liters in twenty-four hours, and one or two eggs, soft boiled or in Stokes' mixture. The following table shows the results:

	Bushuyev.	Sartsievich.
Number of patients	80	70
Recovered	72 (90%)	65 (87.8%)
Average day of illness on admission	7.5	5.8
Day on which recovery was complete	49.5	55
Number of days in hospital	42	49.2
Days of fever in hospital	18.9	22.3
Dismissed incapable of duty	6 (8.3%)	10 (15.4%)
Died	8 (10%)	9 (12.1%)
Day of death	28.6	26.7

We see, therefore, that the mortality was less among the well fed, even though they were further advanced in the disease when admitted,

the duration of the fever was shorter by several days, as was the total duration of the attack. A striking difference existed too in the physical condition of those discharged.

Bushuyev says he was unable to obtain a greater variety of food else he could have excited the appetite of the patients, and in all likelihood they would have eaten more. This apropos of the work of Pavlof previously discussed.

During the year 1897, of 318 patients on a generous diet, twenty-six died, that is 8.2 per cent. This was less than the average death rate for ten years at the military hospital at Kiev, which was 12.4 per cent. Intestinal hemorrhage and perforation were not more common among the well-fed than among those on a purely liquid diet. The mental clearness and general well-being of the former class was very striking. The loss in weight was less than in those on a restricted diet, and they were almost well when the temperature fell to normal. I cannot do better than quote the reviewer, Dr. W. S. Thayer, who sums up as follows: "While one cannot but feel that this is the article of an enthusiast, yet both the reasoning and the figures are such as make us reflect. Is it not more than likely that many cases of typhoid fever suffer from too restricted a diet? Bearing in mind the long course of fever through which the patient must pass, the dangers to which he is exposed not only from exhaustion and the accidents peculiar to typhoid fever, but especially from the various secondary infections to which he is so easy a prey at the end of his long fever and fasting, our main object should be to keep up his general nourishment by every means in our power. Obviously, if a more liberal diet than that afforded by the purely liquid regimen could be assimilated, the patient's strength would hold out materially better. In diphtheria or pneumonia or febrile tuberculosis do we not make an effort to induce the invalid to take as much as he can bear of a simple, easily absorbable and nourishing diet? And yet in typhoid fever we are restrained by a vague fear that any departure from the customary regimen is, for some reason or other, dangerous. What ground have we for this fear? The only answer is a quotation of a case in which, after a long course of fever, with a much restricted diet, some indiscretion has produced a sudden rise of temperature with alarming symptoms. An indiscretion in diet may produce such symptoms in any condition of severe physical exhaustion, but the reviewer has never seen anything to suggest that this is more common in typhoid fever than in any other similar condition."

Shattuck,¹³ speaking on this topic said, "For a number of years I adhered as strictly as possible to an exclusively milk diet in typhoid fever, until a week had elapsed from the date of the first normal evening temperature. I closed my ears to the clamors of adults and my eyes and heart to the tears of children, as I believe now unnecessarily. For five years now, I have been enlarging the diet of my typhoid cases and have seen no reason to regret this course, but on the contrary found cause for satisfaction."

Shattuck treated 233 cases on an exclusively milk diet during seven years, from 1886 to 1893, with a mortality of 10 per cent. During the five years from 1892 to 1897, there were 147 cases on a more generous diet, of whom 8.1 per cent. died. He advises caution in the feeding of typhoid patients, but insists that we are too hide-bound. We should treat the patient and not the disease, and feed him with reference to his digestive powers. He said he had never seen the least harm follow the use of a reasonably liberal dietary. The published reports of liberally-fed typhoid fever cases are not numerous. The papers already quoted, also that of Brummitt¹⁴ dealing with ninety-eight cases with a mortality of 5 per cent., and that of Moorehouse¹⁵ who reports 117 cases, contain the largest number of cases which I found in a search which lays no claim to completion. Desultory reports are heard from time to time however. For instance, Manges¹⁶ says in the discussion of his paper, "a number of cases of typhoid fever were reported in which the patients were, for some reason or another, fed upon solids throughout the whole course of the disease. Among these was one narrated by Dr. Leszynsky. The patient being the wife of a doctor, thought she knew all about feeding and insisted upon a diet of tongue and ham sandwiches, etc. She could not be dissuaded, her chosen diet was regularly given to her; the course of the disease was uneventful. Dr. Kubin stated that while he was house physician of the German Hospital, scraped ham was often allowed without any bad effects. Dr. Koplik said that at Bellevue Hospital Dr. Alonzo Clark and Dr. Delafield not infrequently permitted scraped meat. I may add that during a recent conversation with Dr. Janeway on this topic he told me of a patient at Bellevue Hospital who insisted on being fed on corned beef and cabbage; no harm resulted, since his case pursued the ordinary course." It is useless to quote further. All who have had the courage of their convictions, and have fed their typhoid cases, are a unit in saying that only benefit accrues.

My own experience is comparatively small, dating from 1893, but all of the cases were treated at their own homes, most of them without the inestimable benefits conferred by skilled nursing. If then under such circumstances the patients do well, the adynamia and pronounced wasting are more or less prevented, convalescence is materially shortened and the patient enabled very promptly to resume his customary vocation, it is safe to assert that the results in hospitals would be even better. I do not believe it possible with our present means to shorten an attack, for it is a pretty definitely self-limited infection, but the total duration of disability may be very materially lessened, for it is really remarkable how rapidly those who have been well fed, return to the normal. It only remains to give an outline of the diet advocated. This depends on the type of the attack, on the ability to stimulate the appetite and on the digestive powers of each patient. As to the type of the attack, of course in profoundly toxic cases, or in the delirious or comatose, fluids only can be employed, very little milk, broths, thickened with farinaceous substances, raw eggs in coffee or in broth, tea or chocolate. In those in whom it is possible to create a desire for food, I allow in addition to the above, eggs soft or hard boiled, cereals, milk toast, bread and butter, biscuits, potatoes, macaroni, salad, well-cooked spinach, jellies, custards, puddings, oysters, fish, soups, ripe fruits, care being exercised to remove skin and seeds, and to some patients chicken is allowed. I have never given any other meat, though Bushuyev and Shattuck both allowed other meats, as cutlets and finely chopped or scraped meat. One of my patients, Mary M., had a free hemorrhage of half a pint of blood, followed by the passage of clots and another hemorrhage some twenty odd hours later. She was liberally fed and as she desired and relished food and seemed to digest it, no change was made on account of the bleeding. Still another, Helen S., had an initial attack of moderate severity during which she was well fed. About ten days after the return to normal she had a relapse with fresh spots, epistaxis and headache. The nervous symptoms became alarming and for about twenty-four hours she lay in a marked typhoid state, during which it was impossible to get her to take anything but coffee and egg and a little milk. The moment she was able to take food it was given to her in variety, and her improvement was rapid and the wasting and exhaustion were trifling considering the duration and severity of the attack. Among about 300 autopsies made in the past three and one-half years,

I have never found solid masses in the small bowel, no matter what diet the patient received, unless milk constituted the bulk of the food, then I have found putty-like curds, and in one case I recall particularly, they were pressed together and formed a mass as large as a horse-chestnut in the small intestine and in the large bowel a mass as large as a hen's egg. In another case the bowel had perforated evidently but a short time before death, for the opening was closed by a fecal mass, chiefly a milk curd, and only trifling evidence of local peritonitis existed, without fecal extravasation.

Milk is of course an excellent food, but besides the tendency to form tough curds, patients frequently refuse to take it. They grow very tired of it and the distaste for food thus engendered, makes it difficult to give them the proper amount of nourishment, and to the exhaustion attendant upon the infection, is added the wasting due to starvation. Even when milk is well taken, wasting is very great. I should not care to be understood as advocating a full diet, but I am firmly convinced that patients ill with typhoid may be given quite a variety of foods, not only without harm, but with decided advantage, both as to their condition during the attack, and as a means of effecting prompt restitution of their physical vigor.

The objections of those who have never deviated from a liquid diet in their management of typhoid fever are necessarily theoretical. If they would permit themselves to override a deeply rooted prejudice, cover the label as it were and treat the individual (for once the diagnosis of typhoid fever is made, a morbid fear of anything but liquids enters the minds of most physicians), beginning gradually in each case and enlarging the dietary as the appetite and the digestive power seem to justify, they would find a vast improvement in the general condition of their cases, a speedy return to the normal of those who recover, and probably some decrease in the mortality rate. Certain it is, judging from published reports, that the death rate among the well-fed is a little less than among those on a liquid diet, but as previously mentioned, the prevailing type of the disease must be the chief factor when we see differences such as 10 per cent. or even less, to 40 per cent. Osler¹⁷ gives the cause of death in typhoid fever as follows: (1) Asthenia, (2) intercurrent affections usually caused by the invasion of the weakened organism by other parasites, as pneumococci, streptococci, etc., (3) accidents of the lesions, as erosion of a large blood-vessel or perforation of an ulcer. In conclusion, it only remains to

add that free feeding will undoubtedly serve to diminish the number of deaths from the first and second of these causes. As to the third, those who have employed it are unanimous in their opinion that a liberal diet does not increase the liability to these accidents, on the contrary, rather tends otherwise by increasing the resistance of the individual.

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Surgical Remarks on Typhoid Perforation.

BY ROBERT G. LE CONTE M. D.

In bringing before you for discussion the surgical treatment of perforation during typhoid fever, the time allotted to me is so brief, that I will not attempt to give a review of the subject, nor enter upon the arguments of operation versus expectant treatment. I start with the premise that as soon as the diagnosis of perforation is made, operative intervention is called for, unless the patient is obviously in a moribund condition. If this premise is true the surgical corollary will follow, namely, that the sooner operation is undertaken after perforation has taken place, the greater the chances of recovery in the patient. We might suppose that typhoid perforation would be very similar to appendiceal perforation, but in one important, life-saving particular they differ. In appendiceal perforation the diseased area is usually surrounded by firm adhesions, so that when pus forms it is encapsulated and walled-off from the general peritoneal cavity. It is the exceptional case in which the adhesions are so few or so trifling that a general peritonitis speedily follows perforation. In typhoid perforation, however, the reverse is the case, and the adhesions are usually so slight and friable as to present scarcely any barrier to the fluid poured from the bowel, and it is a very exceptional condition to find

a walled-off abscess. Perhaps the reason for this difference is not hard to find. In appendicitis, occlusion of that organ generally takes place at some point above the perforation, so that the contents of the bowel cannot escape, and the resulting abscess is due only to the presence of the escaped organisms. In typhoid perforation large quantities of liquid bowel contents escape, and perhaps immediately break down the forming barriers and overwhelm the resisting power of the peritoneum. Whether such an explanation is correct or not, the fact remains that little or nothing usually opposes the flow of the bowel contents in typhoid perforation, and a rapidly spreading peritonitis is the ordinary sequel. A fatal result may then be directly attributed to two causes, both of which should, theoretically at least, be preventable; first, delay in operating; and second, surgical errors of judgment and technique.

I. Delay in Operating.—Delay may result from three causes: First, and perhaps in the majority of cases, it is due to the diagnosis not being made for hours, or even a day or more after perforation has taken place. If the symptoms of perforation were always classical and the physician could at once make the diagnosis, the mortality for this dreaded complication would enormously decrease. Unfortunately, the symptoms are often so gradual and so slight that the physician suddenly awakens to the fact that perforation must have taken place, because the signs of an advanced or even general peritonitis are present. Secondly, in a hospital service delay will result from the necessity of getting consent for operation from a parent or relative, and I have known this to lose twelve hours or more of valuable time. Lastly, the surroundings of the patient may be such that a successful operation cannot be undertaken, and delay will result in making the necessary preparations or in transporting the patient to a suitable place. It is, therefore, essential that Osler's advice to us a year ago be followed, viz, that our past cases of perforation should be carefully studied with the hope that they may throw some light on the early diagnosis of this condition; secondly, in a hospital service the consent of a parent or relative for an operation should be gained in all cases of typhoid fever, and lastly, the surgeon must be called at once in order that no time may be lost in the necessary preparations for operation.

The time for a successful operation is the moment the diagnosis is probable, and not when it is made certain by the signs of peritonitis. This will naturally result in a certain percentage of errors, and abdo-

mens have been opened and will be opened when perforation is not present, but I know of no case where this error, *per se*, has caused death. As our knowledge advances this mistake will occur less and less often.

II. *Surgical Errors of Judgment and Technique.*—Let us discuss this part of the subject under four headings: (a) *shock*; (b) *incision*; (c) *treatment of the lesion found*; and (d) *peritoneal toilet and drainage*.

(a) *Shock.*—It has been held by several eminent surgeons that when shock is present with perforation, some hours should elapse for reaction to take place before operation is undertaken. I cannot agree with this view, for every hour that the perforation remains patulous, the greater will be the leakage from the intestine, and the larger the area of soiled peritoneum. Immediate operation will enable us to prevent further soiling of the peritoneum, to repair the injury to the bowel, and to reduce the dangers of a septic inflammation by an appropriate toilet followed by drainage, and also to combat the existing shock and aid reaction by douching the abdominal cavity with hot salt solution. I would, therefore, urge that operation be immediately undertaken, even in the presence of profound shock, as every hour of delay proportionately decreases the chances of recovery.

(b) *Incision.*—In 85 or 90 per cent. of cases the perforation will be found in the last twenty or thirty inches of the ileum, or in the cecum or appendix. In 10 to 15 per cent. other portions of the small or large intestine are affected; notably, the sigmoid flexure, which, after the cecum, is the most likely place to look for perforation. My rule, therefore, is to make the incision directly over that portion of bowel most likely to be affected, namely, in the right semilunar line below the level of the umbilicus, and at once expose the head of the colon. Starting at the ileocecal junction the last three or four feet of the ileum are examined, next the cecum and appendix, and then the ascending colon as far as it can be exposed. If no signs of peritoneal infection are discoverable during this examination, I should consider that an error in diagnosis had been made and discontinue further operative interference. If, however, signs of peritonitis are discovered, but the perforation has escaped detection, I would continue the search by making a median incision, examining the sigmoid flexure, descending and transverse colon, and then the remaining small bowel in the order named. It is well to remember that a perforation may be com-

pletely hidden from sight by lymph, and therefore all areas that are indurated or covered with lymph should be most carefully examined. Incision in the right semilunar line will expose perhaps 90 per cent. of perforations, and in the remaining 10 per cent. it should at least show whether perforation exists in other portions of the bowel, by uncovering some sign of peritoneal inflammation.

(c) *Treatment of the Lesion Found.*—When the perforation is of such size, that closure of the opening will not produce a too marked stenosis of the bowel, it should be sutured at once, either transversely or longitudinally to the lumen of the gut, whichever produces the least narrowing of the tube, and no time wasted in paring the edges of the ulcer. As the wall of the intestine about the perforation is always inflamed and usually friable, the sutures are apt to tear out. For this reason a running Lambert suture is not advisable, as if one point should tear out all the other points of attachment would be loosened. The interrupted Lambert mattress suture gives perhaps the best support with the least danger of tearing out. Having closed the opening our search for another perforation is continued, for in 17 or 18 per cent. the openings are multiple. In other words, the cecum, appendix and lower three or four feet of the ileum should always be carefully inspected, even after one or more perforations have been found and closed, but to search beyond four or five feet of the ileum will waste very valuable time in an operation where speed is of great importance. Sometimes dark necrotic spots will be found in which the ulcer has destroyed the coats of the bowel to the peritoneum, seeming as though but a few hours more would be required to complete an opening. All such suspicious places should be treated as though perforation had taken place, and the weakened areas folded in with sutures.

If simple closure is not practicable, because the opening is too large, or the bowel too inflamed and friable, or the number of perforations and suspicious areas too numerous, four procedures are open to us, and perhaps the life of the patient will depend upon a proper choice of the method. First, a plug of omentum may be fashioned to fit the opening and held in place with stitches, not as a patch is applied to a garment, but as a cork in a bottle. At the post mortem table I have seen a perforation perfectly closed in this manner by nature's processes, with the omentum protruding in the lumen of the bowel. If nature can close rents in this manner the same method is open to the surgeon under certain conditions.

Second, resection of the bowel. This has been done successfully a few times, but the operation is of necessity a severe one and consumes much valuable time. Again the opening may be so near the ileocecal valve as to necessitate a partial resection of the cecum, a procedure which could rarely be done with success in typhoid fever.

Third, the formation of an artificial anus. This would be practicable only in cases with a single perforation, and if successful will in the majority of cases require a second dangerous operation to close the opening. If this method is chosen the bowel should be stitched to muscle or fascia, and not to the skin of the abdominal wall, so as to favor as much as possible a later spontaneous closing of the opening.

Fourth, cutting off the damaged area of the intestine from the general peritoneal cavity by walls of gauze. This again imitates nature's most successful method of opposing a barrier to the further invasion of infectious material. The great advantages of this method are the short time required and the ease with which it can be done, and the fact that a large area of bowel can thus be isolated and all suspicious points included. I have in this way walled off the last two feet of the ileum, the cecum, and part of the ascending colon with perfect success, in a case in which this entire area was so suspicious that any portion of it might have given way in a few hours. Some portions of the bowel did give way the next day, with the formation of fecal fistulæ, but at the end of four weeks the openings spontaneously closed. In this case I feel confident that a resection would have proved fatal, and with the exception of walling off with gauze no other procedure would have been applicable. Of the four procedures mentioned I should prefer the plug of omentum in the very limited number of cases in which it is applicable, and for the others, walling off with gauze, leaving resection of the intestine or the formation of an artificial anus for the exceptional case.

In the rare cases in which the perforation has produced a well walled-off abscess, as is seen in appendicitis, if the incision through the abdominal wall opens this cavity, I should be content to institute drainage, after gently sponging the cavity, and not attempt to find and suture the opening. If, however, the anterior abdominal wall does not form part of the abscess wall, the tumor should be walled off with gauze, the adhesions broken open and the perforation sought for and dealt with radically. It must be remembered that the ordinary typhoid case stands operation well provided it is of short duration, but lengthy

procedures generally result fatally. Other things being equal the most successful operations will be those which consume the least time, and the prolonged procedure should always be rejected in favor of a simple one, provided that life can be saved by the latter.

(d) *Peritoneal Toilet and Drainage.*—When the area of infected peritoneum is limited to the right lower quadrant of the abdomen, I would recommend that the infected coils of intestine be brought outside the wound and carefully cleansed with normal salt solution and gauze sponges, while the cavity within is sponged dry without flushing. The intestines are then returned to the abdomen, a glass or rubber tube carried to the bottom of the pelvis and several gauze wicks, either plain or iodoformized, introduced between the coils of intestine so as to secure good, free drainage. When the signs of peritonitis are limited, flushing the whole abdominal cavity seems to me very dangerous, as the douche may so readily disseminate infecting material to all parts of the peritoneal cavity. I, therefore, prefer cleaning limited areas in the abdomen with dry sponges, trusting to proper drainage to prevent further spreading of the infection. When, however, the signs of peritonitis have extended beyond the median line or above the umbilicus, showing a large if not a universal involvement of the cavity, copious douching must be resorted to. The lateral incision should then be supplemented by an extensive median one, which will permit a considerable evisceration and while the intestines are outside of the abdomen, the cavity must be flushed with large quantities of hot salt solution, while the hand gently stirs the water around to bring it in contact with all of the peritoneal surface. The intestines are then douched and cleansed outside of the abdomen and returned. Free drainage should be provided for with gauze wicks while a tube leads to the bottom of the pelvis. In closing the abdomen only such sutures should be used as are necessary to keep the intestines within the cavity and the rest of the wound should be filled with gauze to secure the best possible drainage. It is also my custom to elevate the head of the patient's bed, to aid the fluids to gravitate to the pelvis where they are removed by suitable drainage, believing that it is safer to have septic or dangerous fluids in that portion of the peritoneum which is least absorbent and remove them by drainage, rather than bring such fluids in the neighborhood of the diaphragm where they will be quickly absorbed into the system.

Of the two causes which we have had under discussion which

aid in keeping the mortality at a high figure, delay is far more responsible than surgical errors in judgment. If the percentage of recoveries is to improve materially, we must look to the physician for an earlier diagnosis in perforation, and the moment it has entered his mind that such a condition may exist, the surgeon should be called in, for his experience has made him more acute in scenting trouble in the right iliac fossa and confidence in surgery has made him more bold; and under these circumstances it is the bold man who is willing to risk an error in diagnosis that will save the most lives.

As an illustration let me relate our experience at the Pennsylvania Hospital. During the past hospital year 509 cases of typhoid fever were admitted of whom thirty-six died, a mortality of about 7 per cent. Of this number eight with perforation were transferred from the medical to the surgical wards and operated upon. Only one recovered. In many of these cases the surgeon operated, not with a bright hope of success, but because the only hope for life lay in operation. Such are the melancholy statistics of the cases transferred from the medical wards; and yet three cases of perforation were admitted directly to the surgical wards and immediately operated upon, with the result that all recovered. I will grant that in two of these cases the diagnosis of appendicitis was made previously to the operation, but the fact remains that serious trouble in the right iliac fossa was at once recognized and an immediate operation saved life. Such contrasting statistics do not of course tell the whole truth, for the cases that came directly to the surgeon were more favorable than those transferred from the medical wards; they had been ill but a short time, probably cases of walking typhoid fever, or else perforation had occurred very early in the disease before adynamic symptoms were pronounced. But such successes make the surgeon feel that if he is given half a chance he can accomplish the desired result.

DISCUSSION.

DR. G. G. DAVIS said that the observations of the last 2 years show that leukocytosis is of corroborative value in the diagnosis of typhoid perforation. Very often there is a very marked change in temperature at the time of perforation. A marked change in temperature also occurs in hemorrhage, but the pain and rigidity are not so apparent as in perforation. Some 2½ years ago he reported 3 cases in which he had operated in typhoid fever, in one of which perforation was found. Six cases are recorded in which operation was done but no perforation found. He feels that if the patients are operated upon at all early they bear operation fairly well and that abdominal section,

particularly if followed by flushing of the cavity does good rather than harm. The use of cocaine he thought reduced the danger from exploratory operation. He thinks that appendicitis is not apt to develop in the course of typhoid fever. The mistaken diagnosis of appendicitis for typhoid fever and the reverse is comparatively common. The operation for appendix trouble has become so frequent that the physicians are becoming almost as radical in their demands as the surgeons and as a result the populace is sometimes eager for an operation. This means that operation will sometimes be done before the diagnosis is established and some mistakes will, therefore, be made. The mortality depends upon early operation and the character of the disease. Reduction in mortality cannot be looked for from any improvement in surgical technique. If, however, the surgeon could have the same support from the physician and from the public in early operations in typhoid fever as in appendicitis he feels that the mortality in typhoid perforations will be much reduced.

DR. H. A. HARE said that while he did not wish to seem to be a therapeutic nihilist he thought in the majority of circumstances it was rather an abuse of therapeutics than otherwise to attempt to control hemorrhage by the administration of drugs. He did not see why a bleeding vessel in the intestine should be regarded differently from a vessel in a man's leg. No one would think of applying a turpentine stupe or of giving turpentine internally or adrenal gland or similar styptics by the mouth to control hemorrhage from a branch of the anterior tibial artery. He failed to see how any of these remedies, even if possessed of hemostatic properties when brought into contact with the bleeding spot could reach that spot and be of use when they had to pass through many feet of stomach and intestine. Saline effusions could usually be employed with advantage with certain limitations. The only remedy which seemed possessed of any advantage, was Monsell's salt given in very hard pill encased in 2 or 3 layers of capsule with the hope that it might get down into the small intestine in sufficiently unchanged form to exercise an astringent influence, although of this he was exceedingly doubtful. In regard to the importance of tenderness in the right iliac fossa in connection with the diagnosis of appendicitis or intestinal perforation Dr. Hare felt that he must take issue to a certain extent with those surgical gentlemen who urged operation in every case in which perforation was suspected. It might be that under certain circumstances it was better for the patient to die of the physician than of the disease, but physicians certainly see, if surgeons do not, instances in which they are almost certain that perforation has taken place and in which the patient or his friends refuse operation and recovery takes place. The subsequent history shows that there was perforation walled off, or that no perforation had occurred. In regard to tenderness in the right iliac fossa, those familiar with the beautiful chart in Kasè and Rümpler's atlas showing the large ulcers in the caput coli, and with Sir Frederick Treves' recent Cavendish Lecture can appreciate the fact that in many cases of suspected appendicitis there is no appendicitis, but a catarrhal condition of the caput coli. He has seen at least 10 or 12 times within the last few years patients who have had all the symptoms of appendicitis, but who have

been saved from operation for appendicitis by some delay so that the development of a rash made the diagnosis of typhoid fever positive. Therefore, he thinks that tenderness in this region, even though very definite, and accompanied by some distention and sense of resistance does not necessarily mean that perforation is present. Dr. Hare emphasized the necessity, in a disease like typhoid fever in particular of not forming positive ideas of diagnosis and treatment unless there are very large statistics. Some years ago he had been amazed to find how the accumulation of statistics in typhoid fever changed his view. There were published in this city at one time a large number of cases reporting various methods of treating typhoid fever. Among these there were 100 cases which gave a mortality of only 2%; then the same plan of treatment gave in the following 10 cases a mortality of 25%. In feeding these cases Dr. Hare is heartily in favor of a much more liberal diet than has been the custom in the past. He does not favor the administration of broths because they offer an opportunity for cultures and cause tympanites. Meats are excluded for the same reasons. He favors very soft boiled eggs, so soft that they could be drunk, and starches like strained rice pudding, not sweet; thin cornstarch; strained wheaten grits. When these starches are given he thinks it necessary to give some starch-digesting ferment such as taka-diastase or pancreatin because in the presence of fever there is a decrease in the secretion of the digestive ferments. He feels that the post-typhoid exhaustion insanities are as much the result of bad feeding as the wasting of the disease. If the feeding is carried out wisely convalescence is much more rapid than when the patient is kept upon a milk diet.

DR. MORDECAI PRICE said that there should be no mistake in the diagnosis between typhoid fever and appendicitis. Cases of gangrenous appendicitis give a typhoid picture; and in these cases the onset of the disease is so rapid and the appearance of the patient so desperate that typhoid fever should be excluded. A second class of cases of appendicitis that resemble typhoid fever are those in which the pus is burrowing up back of the colon and in which there is an almost invisible and subnormal temperature. He feels that the median incision is better than the incision in the semilunar line, in operation for typhoid perforation; because it offers better facility for drainage and for dealing with all parts of the intestinal tract. Although Dr. Le Conte says it is dangerous to use water in appendicitis he believes that the mortality can be lowered from 3% to 5% if water is used instead of sponging.

DR. JOHN H. GIBBON said that he thinks that the surgeons have made a mistake in depending upon the early statistics which show that more cases operated upon between 12 and 18 hours after onset recover than those in which the early operation is done. Dr. Gibbon's experience is limited to 3 cases. The first case was one in which there was a great difference of opinion regarding the exact condition. The diagnosis lay between cholecystitis and perforation. The latter, however, was found. In the next case the operation was done 3 hours after perforation occurred. The perforation was large enough to admit a lead pencil and there was no possibility of turning in the ulcer. Resection of the bowel was done, which he now believes was a mistake. Isolation of the bowel with gauze packing, he thinks, might have saved the

patient's life. The last case was operated upon a week ago and is successful. The operation was done with very few indications. There was rigidity and pain but none of the symptoms of general peritonitis. He believes that the mortality has been lowered by not waiting until the symptoms of peritonitis are present. As in carcinoma of the stomach, if operation is postponed until one is absolutely certain of the diagnosis there is no use in operating. Including the case just reported, there are 4 successful cases of typhoid perforation operated on at the Pennsylvania Hospital. Nearly all of them had been operated on as early as arrangements could be made.

DR. B. FRANKLIN STAHL thinks that in private practice there is a more urgent demand for a greater variety of food than in hospital practice. In the latter there is less trouble in keeping the patients on an exclusive milk diet if such is desired. The only object in view is to successfully and safely nourish the patient, yet it seems that in discussing the diet of typhoid fever men seek the greatest latitude in food substances that may be administered without doing positive violence to the intestinal tract. In this feeding only the albuminoids and starches should be administered. He does not agree with Dr. Hare that meat broths are culture media only and without food value; but he believes it possible to administer sterile meat broths. Straining a meat preparation through cloth is apt to remove the albumin if sufficient heat to coagulate the albumin has been used in its preparation. Beef tea can be made at a temperature not exceeding 160° and can be given after adding to it some hydrochloric acid. Starchy substances, on the other hand, should be given in solution, after straining out all the hard material that might do damage to an ulcerated surface. It is possible to have great variety in the preparation of these 2 classes of foods. The object is not so much to please the palate as to sustain the patient, and if foods are given with a measure of the discrimination exercised in administering drugs better results will be secured.

DR. WILLIAM L. RODMAN said that hemorrhage in typhoid fever should be looked upon largely as a surgical lesion, at the same time he does not see how it can be treated, as suggested by Dr. Hare, as one would treat a hemorrhage from the tibial or other artery. It is almost impossible to locate the hemorrhage unless there is perforation and he thinks it will be a long time before surgeons will be willing to deal in this way with a hemorrhagic case in typhoid fever. He does believe that certain surgical principles should be followed and, therefore, believes that the injection of very hot water into the rectum will do more good than any other remedy. It has been demonstrated that hemorrhage from the stomach has been controlled by such injections into the bowel. If the hemorrhage is not controlled there is a tendency for the heat to combat shock. A parallel should be drawn between gunshot wounds of the abdomen and typhoid perforation. While occasionally spontaneous recovery takes place in the former, especially when the projectile is very small, yet there are very few men who would advise noninterference in gunshot wounds of the abdomen when prompt operation is possible with proper conveniences. He believes that the abdominal cavity should be flushed rather than wiped in cases of peritonitis. In addition to the gauze packing

it might be well, he thinks, in certain cases, to use iodoform gauze with catgut sutures over the opening. He thinks that the operation should be done very promptly when it is possible, but that even *in extremis* operation should be done. Many such cases are being saved.

DR. LE CONTE in closing said that his position on drainage seems to have been misunderstood. When the peritonitis is of large extent, whether general or not, he certainly thinks that flushing is the only method that can possibly benefit the patient, and that the more thoroughly this is done, the better and the greater the chances for recovery. When, however, only a few coils of intestine are infected, and, therefore, but a small portion of the parietal peritoneum involved, he prefers to take out the infected bowel from the abdominal cavity, and wash it outside, not allowing any water to flow inside of the cavity. He believes that a small and limited soiling of the parietal peritoneum can best be combatted by good drainage and by removing the excess of infected material with sponges. This is preferable to running the risk of disseminating that material largely throughout the abdomen with douching.

Intussusception in a Boy of Fifteen Years.

BY MORDECAI PRICE, M. D.

[Exhibited September 24.]

The patient was apparently not over 11 years old at the time of the operation. He had suffered from dysentery 5 consecutive summers. At the time I saw him, on June 28, he had been either in bed or sitting on a chair leaning over a pillow suffering agonizing pain with some diarrhea, but no distention. He had been attended by a number of men, including myself, none of whom had made a diagnosis. He was sent to the hospital and immediately operated upon. On opening the abdomen it was found that the head of the colon had been forced into the colon and all the way round almost to the anal outlet, with a mass as large as my fist at the head of the colon. An effort was made to dislodge the mass with the fingers in the bowel. This was found to be impossible. An incision $2\frac{1}{2}$ inches long was made in the sigmoid flexure, and after considerable effort the mass was delivered through that opening. It was carefully examined and found to be irreducible in size. It was again replaced in the bowel and forced along through the colon until replacement was accomplished. Still no reduction in size of the mass at the head of the colon. The sigmoid opening was closed with silk sutures and the head of the colon examined. The ileum was found to be so injured that it was amputated and reunited with the head of the colon by the Murphy button. The head of the colon was then opened and found to contain hair, epithelial cells and had all the appearances of a dermoid. The dermoid or tumor was removed, the head of the colon resected and reclosed by silk sutures. Careful cleansing of the peritoneal cavity and closure was followed

by an uninterrupted recovery. The morning after the operation the boy stated that he had considerable pain, but no comparison to what he had the night before. He had not a single symptom to indicate danger to life from the time of the operation until he was sent home at the end of 4 weeks. The Murphy button was passed on the fourteenth day after the operation.

A Case of Hydramnios.

BY MORDECAI PRICE, M. D.

[Exhibited September 24.]

The patient is a woman, aged 33 years. About the first of last July, when 7 months pregnant she went to the seashore and about the middle of August she began to enlarge rapidly. About the last of August she was so much distended that each flank bulged out as if from a tumor. A diagnosis of dropsy of the amnion was made. The patient had been vomiting blood for a week; she could not take a particle of food and was in a greatly emaciated condition. Upon examination the cervix was found to be enlarged and dilatable and it was decided to empty the uterus no matter what else might be wrong. The fingers and thumb were introduced about half their length, when it was found impossible to dilate further without doing violence. The amnion was ruptured in the hope that something might happen to help the condition. Immediately the hand slipped into the uterus with the greatest ease, showing that the undilatable condition was probably more the result of the excessive pressure above than from any other cause. The hand and arm were introduced half way to the shoulder and 3½ gallons of water by actual measurement were let out. There was then presented a very beautiful demonstration of the manner in which the placenta is detached from the uterine wall. Feeling that the inertia of the uterus would probably make hemorrhage probable, no immediate attempt was made to remove the placenta. No contractions taking place, the application of vinegar on gauze, promptly effected the result. The uterus in a few minutes contracted, the placenta let go and the membranes came almost into contact. Before this the placenta was fastened only by its circumference. The stomach disturbances cleared up and the woman had an uneventful recovery.

PROCEEDINGS
OF THE
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SYMPOSIUM ON CHRONIC NEPHRITIS.

[October 8.]

The Nervous Symptoms of Chronic Bright's Disease.

BY JAMES HENDRIE LLOYD, M. D.

A prominent clinician of Philadelphia once remarked that the nervous wards of the Philadelphia Hospital were one of the best fields he knew for the study of kidney diseases. This remark made a deep impression on me; and after an experience of fourteen years in those wards I feel entitled to bear witness to the accuracy of his observation. The relation of kidney diseases to nervous manifestations is indeed a very close one, and while no practitioner in any field either of medical or surgical practice, can afford to ignore the kidney in his schemes of diagnosis, I think the neurologist is in a special way obligated to make himself familiar with the symptoms and treatment of Bright's disease. The subject, however, is such a very broad one that for the purposes of such a paper as this the difficulty is to know just how best to present it in a concise and acceptable way.

For purposes of arrangement I may say that the nervous symptoms of Bright's disease manifest themselves (1) in a regional and (2) in a general way. By regional manifestations I mean especially the affections of the cerebrum, and by the general symptoms I mean those that so impair the general tone of the whole nervous system as to constitute a symptom-complex that is not unlike the general state known as neurasthenia.

The regional nervous symptoms of Bright's disease are manifested almost exclusively in the cerebrum. There are few if any spinal or peripheral affections caused by derangement of the kidneys. I think this may be taken as a general law. The one prominent exception is in the case of the optic nerves, but the optic nerves and retinæ are practically prolongations from the cerebral axis, for they are outgrowths embryologically, as is well-known, from the forebrain vesicles. They constitute such a special field that they do not fall to my lot for discussion this evening. But distinctly peripheral parts of the nervous system do not, as a rule, suffer in Bright's disease, and this may be considered as somewhat remarkable. I do not know of any observations that would justify an opinion that peripheral or multiple neuritis, or inflammation of any special nerves, except the second pair, is caused by the general blood state produced by diseases of the kidneys. The various cranial nerves seem to be exempt except in a secondary way, or except as they may cause the symptoms of neuralgia and cephalalgia, which are sometimes early manifestations of Bright's disease.

Headache as an early symptom of chronic nephritis is a symptom of exceedingly great importance. I am not prepared to say that it is very common, but I am confident that it is sometimes overlooked or misinterpreted. I can recall cases in which this symptom was treated for any and everything except for the real thing that it was. In this day of polypharmacy, when, like the homeopaths, we have a dozen drugs for every symptom, the risk is very great that the insidious headache of Bright's disease will be treated with every coal tar product under the sun before the patient falls into the hands of some doctor who is wise enough to examine the urine. There is no isolated symptom that should do more to teach us the unfailing rule that every patient, no matter what his ailment, should have the benefit of a urine analysis. There is only one other type of headache that is sometimes more obscure and intractable—I refer to the morning headache of gout. To distinguish between the two is not always easy; the gouty patient may, indeed, have poor kidneys, but there is nothing that will cure his headache more effectually than a good old-fashioned inflammation of his big toe. I recall the case of a gentleman who suffered for a long while with severe morning headache. I examined his urine frequently and found some slight indications of trouble, and for want of a better diagnosis I began to fear that his kidneys were at fault;

but one day he wore a tight, new shoe; that night he had a surprisingly active attack of toe gout, and his morning headaches, and my diagnosis of Bright's disease, disappeared like magic.

The headache of Bright's disease, however, is rarely a truly isolated symptom. There is generally some associated failure of health, appetite, strength and nutrition—a general neurasthenic state, in fact, of which I shall speak later. The severe headache of uremia is sometimes associated with nausea and vomiting in such a way as to suggest gastric disorder, or even to simulate migraine. Its likeness to the latter disorder is increased by the associated amblyopia due to beginning changes in the retinae and optic nerves. It is only a very careless observer, however, who would make the mistake of confusing the two diseases, for, even if a urine analysis were omitted, the fact would remain that migraine is a constitutional disorder, dating from early life. A pseudomigraine, beginning in adult life, should always excite suspicion either of Bright's disease or of some organic disease of the brain. A urine analysis and an ophthalmoscopic examination are the crucial tests in such cases.

Some authors refer to deafness, with associated giddiness, as being caused by Bright's disease, and seem to think that the underlying condition is an affection of the auditory nerves somewhat similar to that which occurs in the optic nerves. But this is largely speculative.

The *regional*, or cerebral, symptoms of chronic Bright's disease are among the most striking, and most interesting of all the manifestations of that affection.

The phenomena of an ordinary uremic convulsion are probably familiar to all physicians. A mere clinical description of them is certainly not called for here, and I have therefore thought that the wisest thing to do in this paper would be to discuss some of the diagnostic problems involved.

It may be said briefly that uremic encephalopathy includes far more than a mere uremic convulsion. By uremic encephalopathy I mean that general assemblage of brain-symptoms which is caused by the poison of uremia in the blood. Just as in lead poisoning, so in Bright's disease, there is a somewhat characteristic marshalling of brain symptoms which forms a clinical picture. This is called an encephalopathy, and may be briefly analyzed.

Its most conspicuous symptom is the uremic convulsion, the

prodromes of which are often the headache and amblyopia already described. Mental confusion and stupor often precede the fit. There may also be slight illusions and hallucinations, or a semi-delirious state. In some cases, however, the onset of the convulsion is sudden or explosive, and it is succeeded by a profound and prolonged coma. This coma is interrupted by renewed convulsions, and thus the patient passes from a critical state of coma to a still more critical state of eclampsia. What I want to say particularly is this, that there is nothing absolutely distinctive about the convulsion and coma of uremia. In other words, taken by themselves, we cannot distinguish them from the coma and convulsion of other conditions. The sub-normal temperature, upon which some teachers insist, is by no means constant in these cases. The diagnosis must be made by a process of exclusion, by a history of the case, and by an examination of the urine, and even then some of these factors are so uncertain that an accurate diagnosis is often difficult. I know of no more difficult problem than that which presents itself sometimes to the clinician when he is suddenly confronted at the bedside with a case of profound unconsciousness, and is expected to make an off-hand diagnosis with the aid only of an imperfect history of the case. I should like to illustrate this with some personal experiences.

I was once called at midnight to a gentleman in middle life who had been seized with a convulsion. When I reached his side I found him lying half-dressed and in a profound coma. He was alone in his house with a servant. I had known him and had been his family physician for years, and had never known of his being in poor health during all that time. I spent an anxious night with him, and saw him pass from one convulsion into another in the midst of a deeply comatose state. I feared naturally that he was suffering with uremia and that it was a case of unsuspected Bright's disease. Toward morning I secured a small amount of his urine, and boiling it in a spoon over a gas light found that it was free from albumin. This, however, did not necessarily exclude uremia. The patient's family were all out of town, but in the morning his wife returned, and to my surprise seemed not in the least alarmed. Taking me to one side she told me in confidence that her husband had been subject for twenty years to nocturnal epilepsy, and that no one outside of the immediate family circle knew of this distressing malady. Although I was the family physician, I had thus discovered this secret by acci-

dent. If the wife had been at home, I should not have been called in. The remarkable feature of the case was that the patient, whose seizures were only at long intervals, had never been known to have a convulsion during the day time.

Another case was not so fortunate. This last summer I saw in consultation a lady in a nearby town, who after a week of obscure ill health, marked especially by intense headache and some febrile reaction, had passed suddenly into a deep coma. She had a history of having had a suppuration of the ear one year previously. This, however, had been healed for a full year, and an aurist, who examined the ear the day I saw her, could discover no evidence of active disease. Her local physicians suspected (and very properly suspected) a brain abscess, and wanted a neurological consultant to discuss the advisability of a surgical operation. When I reached the patient she had been unconscious (and deeply unconscious) for nearly twenty-four hours. She was in fact in a dying condition, and did die five hours after I saw her. When asked whether there had been a urine analysis I was told that none had been possible, because the patient had complete suppression of urine. I desired that she be again catheterized in the hope of obtaining a specimen, but again the bladder was found empty. I then took the position very positively that our ignorance of the state of the kidneys, and in view of the patient's critical condition, and the absence of all localizing symptoms, it would be unjustifiable to operate. While it was very possible that the patient had pus within the cranium, it was impossible to say where it was, or even that it existed at all, and no surgeon should operate on such a patient without knowing the state of the kidneys. The possibility of such a condition being due to uremia was too great for us to hazard an

Erratum.

In the paper entitled "The Nervous Symptoms of Chronic Bright's Disease," by James Hendrie Lloyd (No. 3, page 295) the seventeenth to the twenty-fourth lines from the top should read: When I asked whether there had been a urine analysis I was told that none had been possible, because the patient had complete suppression of urine. I desired that she be again catheterized in the hope of obtaining a specimen, but again the bladder was found empty. I then took the position very positively that in our ignorance of the state of the kidneys, and in view of the patient's critical condition, and the absence of all localizing symptoms, it would be unjustifiable to operate.

died on the operating table. And this leads me to discuss the simulation of organic brain lesions by Bright's disease.

It has been known for some years that the brain-symptoms caused by uremia may closely resemble those of organic diseases within the cranium. The commonest of these diseases to be simulated are tumor of the brain, cerebral hemorrhage and cerebral embolus; and the commonest symptoms are hemiplegia or hemiparesis, localized pain or tenderness and various forms of speech-defect or aphasia. These symptoms, or various combinations of them, associated as they may be with changes in the optic nerves, may present a picture that is most deceptive. For instance, a right-sided hemiplegia, with aphasia, with pain more or less referred to the left side of the head, and with an inflamed or degenerated state of the optic nerves, is a condition which is apt to give us pause. A brain tumor has been correctly diagnosed more than once on no better grounds—and yet I have seen such a complex of symptoms occur in the course of Bright's disease, and even temporarily clear away, all except the changes in the eyegrounds. Even these, too, are susceptible of improvement. There was quite a celebrated case in my wards at Blockley a few years ago. The patient, an Irishman, had some motor aphasia, associated with paresis of the right side of the face. He also complained of great pain and tenderness on pressure over the left Rolandic region. I quote from memory, but I think his eyegrounds also were involved. The semblance to a strictly localized lesion, especially a neoplasm, was very great, and the patient came near getting trephined. A more careful study, however, demonstrated that the whole trouble was uremic, and the patient improved very much under treatment, and left the hospital with a whole head but with bad kidneys.

It should be remembered that the fact that a patient has albumin and tube-casts in his urine is no proof that he may not also have a brain tumor. Herein lies the difficulty. I have heard recently of a man being admitted in an unconscious state to a hospital in this city, whose case was diagnosed as uremic coma, but a more careful examination showed that he had a fractured skull. The moral is obvious. Only a careful investigation can save us from error. A man with Bright's disease can sustain a fracture of the skull.

The subject of uremic aphasia has been presented so ably by Dr. Riesman in his paper at Saratoga last June, that I do not feel like enlarging much on it. One of the cases to which Dr. Riesman referred

occurred in my wards at the Philadelphia Hospital. The case was reported by me to the Pathological Society. This woman had complete motor aphasia, complete word-blindness and complete agraphia. She could, however, understand all that was said to her. Thus the complexus of symptoms included all modes of speech, except word-hearing, and as the involved speech centres are not contiguous, the problem was to locate a lesion that would include them all without causing hemiplegia or any other paralytic symptoms. This problem was not satisfactorily solved at the bedside—but the woman soon died with symptoms of uremic poisoning, and the autopsy revealed absolutely no gross lesion in the brain. There were only atheromatous arteries. But advanced kidney disease was found, with an immense cystic degeneration in one kidney.

In attempting an explanation of these cases we must, I think, fall back on the theory of a vascular lesion. Because of varying conditions of degeneration in the arteries, some vessels more than others obstruct the blood current, and focal lesions in the brain are produced. The uremic poison in the blood may in addition act as a paralyzant on the starved tissue. In no other way can we explain the fact that the symptoms are sometimes temporary.

In concluding this paper, I wish to call brief attention to the curious hysterical and neurasthenic symptoms that sometimes occur in the course, especially the early course, of Bright's disease. The nutritional derangement of the nervous system causes a loss of nerve tone. There are obscure symptoms, such as headache, dyspepsia, loss of weight, inability to attend to work, emotional and other deranged psychic states, all of which may lead to a diagnosis of that fashionable disease known as neurasthenia. I have a suspicion; in fact, I have seen evidence, that such cases are sometimes given rest treatment with the idea that they are purely neurotic. The only safe rule in such cases, as in fact in all cases, is to make a diligent search of the urine; and I think I cannot close this paper more appropriately than to say that no man has ever properly diagnosed any case until he has made a urine analysis. I need only quote the language of Sir William Gull: "What can a doctor know about a man, if he knows nothing about his urine?"

The Ocular Manifestations in Chronic Bright's Disease.

BY G. E. DE SCHWEINITZ, A. M., M. D.

The ocular lesions which may be associated with or caused by various forms of Bright's disease are these:

(1) Complete blindness without ophthalmoscopic lesions, or at least without the presence of lesions more or less suggestive of disease of the kidneys, generally called uremic amaurosis and most often seen in acute nephritis, but also in acute exacerbations of chronic renal disease.

(2) Various types of retinitis and neuroretinitis to which the descriptive term "albuminuric" is commonly applied, and which are most often seen in association with chronic forms of kidney disease.

(3) Alterations in the caliber and relation of the retinal vessels owing to sclerotic changes in their walls, with or without hemorrhages and exudates in the retina, seen in association with those forms of renal disease in which vascular changes are evident elsewhere in the body; also isolated hemorrhages and exudates, without marked vessel-wall changes.

(4) Alterations in the uveal tract, particularly in the choroid and iris.

(5) Some varieties of cataract.

(6) Paresis and paralysis of the ocular muscles, particularly the superior oblique and the external rectus.

(7) Recurring subconjunctival hemorrhages.

In uremic amaurosis the loss of sight is often sudden, bilateral and complete, so that even the perception of light is lacking. In other instances light perception is not wanting and never entirely disappears, the visual disturbance coming on gradually. Sometimes the pupils are irresponsive to light stimulus, sometimes they react to light impulses. Ophthalmoscopic examination may be negative, but may also reveal a general edema of the retina, an edema located particularly around the optic nerve entrance, the so-called peripapillary edema, and fulness and tortuosity of the retinal veins. In a case recently seen in consultation with Dr. B. C. Hirst and Dr. James C. Wilson this general edema of the retina was well-marked, the appearances being best described by the word "foggy." Hemorrhages, exudations in the form of white plaques so characteristic of the various types of renal retinitis, are usually lacking.

Uremic amaurosis, to quote a sentence of J. B. Lawford, "may occur in any of the various forms of renal disease in which there is sufficient interference with excretion by the kidneys to load the blood with those poisonous materials, whatever their exact nature may be, which induce the uremic condition." It is, however, more common in acute nephritis, particularly the nephritis associated with scarlet fever and pregnancy. Occasionally uremic amaurosis occurs in chronic nephritis which has already produced organic changes in the retina.

Whether the ordinary uremic amaurosis is due to the action of a toxin on the cortical centers or on the retina is in dispute. Retention of the pupillary light-reflex with absolute blindness would indicate a lesion in the visual tract higher than the primary optic centers. It has seemed to me in some cases that I have studied, particularly the one already referred to, that the retinal elements themselves were intoxicated, and I know no reason why one should not assume that the toxic agent which the diseased kidneys has failed to eliminate should not act on the ganglion cells of the retina, just as many other toxic agents, for example, the toxin of diabetes and certain toxins brought about by intestinal fermentations similarly act.

Systematic writers have divided the various types of retinitis and neuroretinitis associated with kidney disease as follows: Typical albuminuric retinitis, degenerative albuminuric retinitis, hemorrhagic albuminuric retinitis, albuminuric neuroretinitis, and albuminuric papillitis.¹ Now while it is true that these various forms occur, for practical purposes it is sufficient to recognize two varieties, an inflammatory or exudative and a degenerative type.

In the typical disease variously shaped and placed white spots appear in the macula or in its immediate neighborhood, sometimes at first discrete and sharply separated, but later and under other circumstances forming a star-shaped figure the rays of which may completely or partially surround the fovea. Near the papilla and often surrounding it large yellowish-white spots and plaques appear, so that there is a ring-shaped zone around the nerve-head, forming a striking white area, to which the name "snow-bank of the retina" has sometimes been applied. Linear, flame-shaped or round hemorrhages are scattered over the fundus. The bloodvessels may be partly buried in white exudate or pass over it. The veins are frequently dark, tortuous and distended, the arteries not infrequently unchanged in size or smaller than normal. The optic papilla may be hyperemic, actually

swollen, sometimes decidedly choked and presenting all of the appearance of an intense optic neuritis.

Such appearances, however, representing a picture which is exceedingly familiar and which at one time was believed to be absolutely characteristic of chronic Bright's disease, may be substituted by lesions which consist of white spots, often quite small and often separated by nearly normal areas, comparatively inconspicuous hemorrhages chiefly confined to the fiber layer of the retina, and changes in the vessels indicating sclerotic conditions of their walls to which more accurate attention will be called later. This is the so-called degenerative type.

When there is a great involvement, both of retina and optic nerve, with marked exudations, hemorrhages and inflammatory signs, the term exudative or inflammatory neuroretinitis is applied.

If the hemorrhages are the most conspicuous feature of the disease, there is no objection to the term "hemorrhagic," while if the optic papilla alone is chiefly involved, as is sometimes the case, we may use the term neuritic or albuminuric papillitis.

That small, comparatively insignificant white dots or small, soft, fluffy exudates, with here and there a hemorrhage, may be the first signs of renal retinitis is well known, and such appearances, especially if associated with vascular and perivascular changes presently to be described, should always call for a thorough urinary examination.

In recent times much attention has been paid to the ophthalmoscopic appearances which are seen in general arteriosclerosis and which, indeed, are in many respects far more important from the diagnostic standpoint than the more or less typical types of renal retinitis, because, as a reviewer of Tirard's work on albuminuria and Bright's disease has well said, "these changes are often obvious in cases in which the usual retinitis has not developed." These changes have been discussed by a number of observers, particularly by Raehlmann, Hirschberg, Friedenwald, Marcus Gunn, myself and others, and I have reviewed them somewhat in detail in my address before the Medical and Chirurgical Faculty of Maryland, April 26, 1900.² Quite recently Raehlmann has returned to this subject in an excellent article³ which deals with the ophthalmoscopic diagnosis of sclerotic disease of the retinal vessels and in which the literature is extensively quoted. From my own paper, following Mr. Marcus Gunn's admirable

classification, I may be permitted to quote the ophthalmoscopic signs which may be encountered in general arteriosclerosis and therefore in many cases of chronic renal disease:

"(1) Alterations in the course and caliber of the retinal arteries, manifesting themselves as (a) undue tortuosity, which is not significant unless, to quote the words of Mr. Gunn, it is associated with other evidence of disease; (b) alterations in the size and breadth of the retinal arteries, consisting of general contraction of one or more branches, or, more suggestively, of alternate contractions and widenings, where, for example, a vessel may proceed with practically normal caliber for a certain distance, then suddenly narrow almost to a thread, again fill out, and again narrow, thus presenting, as it were, a beaded appearance.

(2) Alterations in the reflections from, and the translucency of, the walls of the retinal arteries, manifesting themselves (a) in increased distinctness of the central light streak on the retinal vessel and an unusually light color of the entire breadth of the artery. The vessels, as Mr. Gunn points out, give the impression not only of increased brightness of the central light streak, but of an unusual reflection from the arterial coat. (b) Loss of translucency, so that it is impossible to see, as is possible in the normal state, through the artery an underlying vein at the point of crossing; (c) positive changes in the arterial walls, consisting of whitish stripes, indicating degeneration of the walls, or infiltration of the perivascular lymph sheaths.

(3) Alterations in the course and caliber of the veins, together with signs of mechanical pressure, manifesting themselves (a) in undue tortuosity, which, as in the case of the arteries, is not significant except in the presence of other disease; (b) alternate contractions and dilations; (c) an impeded venous circulation where a diseased artery crosses it.

The last is the sign which Mr. Gunn particularly dwells upon, and which, in my experience, is of the utmost importance. Ordinarily, as an artery crosses the vein, as may be seen by an examination of the normal eyeground, there is no sign of pressure, and the translucent vein permits a view of the artery beneath it. If the walls of the artery are thickened by disease, then it presses upon the vein, pushes it aside, or directly contracts its caliber, so that beyond the point of crossing there is an ampulliform dilation. So, also, when the vein

overlies the artery there may be a similar contraction of the venous caliber and dilation on either side of the spot of crossing. (d) Changes in the venous walls, precisely as they occur in the arteries, so that whitish stripes border the vessel, and are indications of degeneration in its walls. Often associated with this one may see varicosities, as already pointed out by Raehlmann.

(4) Edema of the retina, manifesting itself (a) as a grayish opacity, which may be present in the immediate neighborhood of the papilla, or in spots over the eyeground and along the course of the vessels, looking like a fine gray haze, or in little fluffy islands far out in the periphery.

(5) Hemorrhages, manifesting themselves as linear extravasations along the course of the vessels, roundish infiltrations scattered over the fundus, or sometimes, when extensive, in droplike form, especially in the macular region, forming the so-called subhyaloid hemorrhages. As a result of hemorrhages there are frequently scattered through the eyeground yellowish and whitish-yellow spots bordered with pigment, indicating the atrophy of the elements that has taken place during the course of the absorption of hemorrhage."

Varieties of Renal Disease Which Produce Retinal Lesions.—In general terms it may be said that ocular lesions may occur with any form of nephritis, but there is no question that the various types of retinitis are most frequently associated with chronic interstitial nephritis, that is with renal sclerosis, whether this is an independent primary affection or whether it is a sequel of arteriosclerosis. Various types of retinitis and retinal lesions may be symptoms of chronic parenchymatous nephritis. Some observers, for example, Samuel West⁴ make a sharp distinction between the degenerative and exudative forms of albuminuric retinitis, believing that the former is indicative of chronic granular nephritis and that the degenerative changes depend upon vascular alterations, while the latter indicates a chronic parenchymatous nephritis and depends upon an inflammatory or toxic influence.

Naturally, the so-called secondary contracted kidney which is a sequence of the large white kidney may be associated with retinitis. The statement is frequently made that amyloid disease of the kidney produces albuminuric retinitis, and of course there is no reason why it should not, because lardaceous degeneration of the kidneys is not a separate disease but purely an event in the course of Bright's

disease, most frequently, if I mistake not, occurring in parenchymatous nephritis of cachectic origin. Although uremic amaurosis, to which reference has already been made, is generally seen with acute forms of Bright's disease, there is no reason why an amaurosis of this character should not take place, as, indeed, it not infrequently does take place, during the course of a retinitis caused by chronic kidney disease as the result, for example, of an exacerbation of the renal lesions.

Date of Occurrence.—It is practically impossible to state exactly when the retinal lesions of renal disease will appear. At one time it was supposed that they began at the same period that cardiac hypertrophy was manifest, but this certainly is not a constant association. In general terms, I think it may be stated that the renal disease has been present for some months before the retinal lesions appear, but the very fact that the retinal lesions may be the very first signs of the kidney disease, indeed, the means by which the kidney disease is discovered, renders the answer to the question all the more difficult.

While it is true that retinitis, retinal hemorrhages, etc., may precede albuminuria by a considerable length of time, it is probable, as Dr. Sutton suggests, that these are examples of granular kidney in which albumin is absent, or only present to a very small extent until a later stage of the kidney affection.⁵ On the other hand, the lesions which I have described as occurring in the bloodvessels, particularly various types of perivasculitis, and of "silver-wire arteries" producing compression upon under- and overlying veins, are often present for long periods before the renal lesions are manifest, or at least, before the other signs of renal disease are fully established, that is albumin and casts. It is for this very reason that they as part of the symptomatology of arteriosclerosis which may eventuate in renal sclerosis, are so exceedingly important. More than this, they may be obvious in cases in which the usual renal retinitis will not develop, because they are forerunners of a process which, as I have elsewhere pointed out, may terminate fatally before the development of fully established nephritis.

Age in Which Renal Lesions Occur.—Inasmuch as chronic interstitial nephritis is a rare disease before the twenty-fifth year, its percentage rising between that age and forty and growing still greater between forty and sixty, the retinal lesions are likely to appear at the same age, but it should be remembered that they may occur at any age

and that even children are not exempt. I do not now refer to uremic amaurosis, for example, in scarlatinal nephritis, but to the fact that the so-called typical albuminuric retinitis is seen in children. A good example has been reported by Mr. Arnold Lawson and Dr. G. A. Sutherland⁶ the patient being only twelve years of age. The youngest case recorded by Bull⁷ in his analysis of 103 cases of exudative neuroretinitis associated with chronic Bright's disease was five years of age.

Frequency of Renal Lesions in Chronic Bright's Disease.—As J. B. Lawford⁸ states, it is difficult to ascertain the proportion of renal disease in which retinitis occurs. He quotes the following percentages: 9 per cent. (Wagner), 13 per cent. (Wadsworth), 28 per cent. (Eales), and 33 per cent. (Galezowski), and expresses the opinion that the figures of Eales and Galezowski most nearly represent the correct percentage. According to William F. Norris, than whom there was no more careful observer, fully 25 per cent. of the cases of chronic Bright's disease as they occur in general hospitals are affected by various forms of retinitis. My own experience yields an equally great, if not greater percentage, and, if the cases in which not alone more or less typical forms of retinitis and retinal lesions are included, but also those in which the ophthalmoscopic signs are comparatively insignificant, existing chiefly in the forms of alterations in the walls of the retinal vessels, the percentage will rise much higher.

Prognosis.—The prognosis *quoad visum* depends entirely upon the character and situation of the exudates, *i. e.* upon the amount of distinction of the percipient elements of the retina. Not infrequently florid types of albuminuric retinitis, *i. e.*, the so-called inflammatory or exudative varieties, clear up more decidedly and more rapidly than the less pronounced varieties of the disease; but I believe with Charles S. Bull and William F. Norris that although improvement in vision often occurs, indeed sight may rise to the normal standard, there is rarely, if ever, entire disappearance of the stellate exudate in the macula. Even when albuminuric retinitis is caused by a syphilitic affection of the kidney, and appropriate treatment causes absorption of the retinal hemorrhages and exudates with restoration of perfect vision, some white stellate dots are left in the macula, as in a recent case admirably reported by C. Zimmerman.⁹ Some authors, for example, C. A. Oliver¹⁰ have described a marked difference between the ophthalmoscopic conditions seen in interstitial nephritis as found

in dispensary service and general hospital practice. In the latter the eyeground is often examined in the incipency of the disease, or when the lesions are most pronounced; in the former the active retinal lesions have often largely subsided and the secondary degenerative changes are evident, with a marked depreciation of vision, which, indeed, has caused the patient to seek advice, and by reason of which the disease from which he is suffering has been discovered. The bearing of these facts on prognosis is evident.

Deterioration and destruction of sight may also occur as the result of detachment of the retina, secondary atrophy of the optic nerve, retrobulbar neuritis and hemorrhages into the optic nerve sheath and secondary glaucoma.¹¹ It is possible that detachment of the retina may occur independently of the retinitis, although I do not think this has been definitely proved; doubtless it is more common, as Lawford maintains, than is generally supposed.

The prognosis *quoad vitam* is bad. In Bull's list more than 50 per cent. of the cases died within the first year, and in general terms it may be stated that it is exceedingly uncommon for patients with albuminuric retinitis to live longer than two years. Of course I know there are exceptions to this rule, that patients have lived five, seven and even greater number of years after the retinal lesions have developed. In this particular there is a marked difference between hospital and private patients. Naturally, those who can afford the best treatment, climatic, as well as dietetic and therapeutic, have the best chance for prolonging their lives. Belt's statistics are interesting in this particular. He collected 155 cases from private practice, of which 62 per cent. died within one year, 85 per cent. in two years, and 14 per cent. lived more than two years. He collected seventy-five cases from hospital practice, and of these 85 per cent. died within one year, 93 per cent. within two years and 6 per cent. lived more than two years.

That the prognosis of retinitis associated with the albuminuria of pregnancy and scarlatinal nephritis is much more favorable than the retinitis of chronic Bright's disease is well known, but does not come into discussion in the present communication. Whether successful decapsulation of the kidney for the relief of chronic nephritis is followed by notable improvement of coexisting retinal lesions I do not know. This subject is now being investigated by Dr. Suker, of Chicago.

Diagnosis.—Nearly thirty-five years ago, that singularly keen

observer, Mauthner, said that the appearance of the retina so frequently found in chronic Bright's disease was absolutely characteristic of the kidney affection, and that the ocular examination under these circumstances was more satisfactory than a urine analysis. I am inclined to think that this belief is still widespread; but it is not entirely accurate. So long ago as 1869 Schmidt and Wegner¹² pointed out the similarity of the neuroretinitis of brain tumor and of Bright's disease and reported a case of bilateral neuroretinitis with all of the appearances which are considered characteristic of retinitis albuminurica, but in which the post mortem showed a gliosarcoma of the brain and that the kidneys were entirely normal. Von Graefe himself, prior to Schmidt and Wegner's paper made a similar observation. The subject has been well discussed by Mr. Marcus Gunn,¹³ whose experience agrees with that of Dr. James Taylor that where the macular figure occurs with brain tumor the neoplasm is usually in the cerebellum. That also has been my own experience and I have seen and studied with Dr. A. G. Thomson in the Infirmary for Nervous Diseases several cases of cerebellar tumor in which the lesions, the macular ones at least, exactly simulated those which are most often caused by chronic Bright's disease.¹⁴ I have, however, also seen the macular figure well marked in one case of tumor of the parietal convolutions in the Philadelphia Hospital. Not only does the star-shaped macular figure occur in the neuroretinitis of brain tumors, but it is also seen in syphilitic retinitis and in retinal hemorrhages, especially as they occur in young people. Indeed, Haab believes that this figure is simply a representative of an intense vascular disease with interference of the retinal circulation, and is caused by the accumulation of fatty granules in the cone fibers of the macular region, and is not due, as is often taught, to fatty degeneration of the ends of Müller's fibers.

The occasional similarity between cerebral neoplasm and chronic Bright's disease is not limited to the neuroretinal lesions. Not infrequently, as Charles W. Burr¹⁵ has well shown, there is distinct mimicry of brain tumor by chronic nephritis in its general and particularly its nervous manifestations.

Usually both eyes are affected in albuminuric retinitis, although it is common to find more extensive lesions in one eye than the other, just as one kidney is often more diseased than its fellow, but it should be remembered that unilateral renal retinitis, to quote Knies's expres-

sion, is not a rarity. This fact I have elsewhere discussed.¹⁶ A certain percentage of cases maintain monocular retinal lesions until death. In another larger percentage of cases the unilateral character of the affection continues for a certain period of time, but ultimately becomes bilateral.

Many of the retinal lesions which one sees in association with chronic Bright's disease cannot be said in one sense to be typical of this affection, for example, single or scattered hemorrhages without white exudates, certain forms of perivasculitis, and particularly the alterations in the caliber of the vessels of the retina already described. They are, if you choose, significant of arteriosclerosis and in that sense significant of a condition which may eventuate in chronic nephritis, if this disease has not already appeared. At all events, they are strong indications for thorough urinary analysis; indeed, the same may be said to be true of any retinal condition where hemorrhages and vascular changes exist, be they great or small.

Diseases of the Uveal Tract in Chronic Nephritis.—In many cases of retinitis albuminurica the underlying choroid is also affected by inflammatory, vascular and exudative disease, but the choroidal lesions are not evident to the ophthalmoscope and can be seen only on microscopic examination. Special forms of choroidal disease, however, somewhat resembling pigment degeneration of the retina have been described. Iritis is occasionally observed. According to Knies, in the absence of any other cause, an iritis or iridocyclitis might be attributed to albuminuria because the latter is often associated with extensive disease of the iris vessels, and therefore this membrane will be susceptible to those causes which readily excite iritis. In the Philadelphia Hospital I have on a number of occasions found albumin in the urine of patients suffering from iritis, but I have never been able to establish a causal relationship because there were too many other likely and well-known etiological factors that could not be eliminated with certainty.

Nephritic Cataract.—Various types of Bright's disease have been brought into connection with the formation of cataract, particularly by Deutschmann.¹⁷ In his last communication on this subject he reported the examination of 230 patients with uncomplicated cataract, among whom 5 per cent. were undoubtedly nephritic and 11 per cent. probably affected with Bright's disease. Most elaborate examinations to determine this point and to test the trustworthi-

ness of Deutschmann's albuminuria theory have been made by Evetzky,¹⁸ whose results indicate that albumin does not mean nephritis, that nephritis and cataract may combine, that in young nephritics there is no cataract and in old ones not more, usually, than in those who are without the signs of Bright's disease. In other words, a causal relationship between nephritis and cataract has never been established.

Ocular Muscle Palsies Due to Nephritis.—These must be rare, or perhaps are only rarely reported. Knies has particularly called attention to them and has recorded abducens paralysis, superior oblique paralysis and external ophthalmoplegia. To this list may be added a good report of paralysis of the superior oblique in nephritis by H. F. Hansell.¹⁹ One point is of importance from the prognostic standpoint, namely, as Knies points out, these muscular palsies may be terminal symptoms of albuminuria. They are indicative of changes in the cerebral vessels similar to those which are found in the retina and elsewhere in the body.

Recurring Subconjunctival Hemorrhages.—In general terms it is well known that recurring subconjunctival hemorrhages may be a sign of chronic renal disease, but I am inclined to think that this manifestation has not received the place it deserves among the ocular signs of nephritis. To be sure, a number of writers, for example, Talko, D. B. St. John Roosa, Frank Ring, Charles Stedman Bull and myself, have called attention to this matter, but more commonly text books when describing nephritis are silent with reference to this symptom, although other hemorrhagic phenomena, epistaxis, purpura, retinal extravasations, etc., are recorded. I have discussed this matter in some detail in an oration before the Medical and Chirurgical Faculty of Maryland, and may perhaps be permitted to quote from that paper: "In my experience these subconjunctival ecchymoses have occurred in persons past forty, and usually during sleep, the patient being surprised on waking in the morning to find a more or less extensive subconjunctival extravasation, most frequently, I think, in the left eye. In one case they may occur at comparatively short intervals; in another the periods between the attacks may comprise several weeks or even months. In five cases seen recently, three of the patients having died, the ages were in two between forty and forty-five, in one between fifty and sixty, and in one between sixty and sixty-five. The fatal issue occurred within three years after the first subconjunctival

hemorrhage was noted, and these hemorrhages were the first sign which called attention to the chronic contracted kidneys from which they all suffered. What the relative frequency of these subconjunctival hemorrhages is compared with other more commonly described ocular manifestations of nephritic origin is not apparent, owing to insufficient data. Sometimes it would seem that they may be associated with the ordinary retinitis of nephritis, but this is not my own experience. Sometimes in a certain sense they may at times replace the retinal lesions of chronic nephritis; certainly they may precede them. If this association of Bright's disease and recurring subconjunctival hemorrhages is a matter of common observation, as indeed it well may be, at least the fact has not been emphasized, and the simple rule to examine the urine carefully in each such case may lead to the discovery of a serious renal disorder, which, as William Osler has said, is frequently latent, and even in an advanced grade may be compatible with great mental and bodily vigor.

Of course, hemorrhages of this character occurring in elderly people are indicative of ordinary angiosclerosis, and are only one of the many signs of this condition, but what I wish to point out is that they are not confined to the eyes of old people, but may be seen, as I have just quoted, in those not much over forty, and in subjects, moreover, in apparently perfectly vigorous health, and when signs of arterial degeneration are not evident in the radials or temporals. One patient to whom I have referred scouted the idea of the necessity of urine examination, although within three months he had had three spontaneous subconjunctival hemorrhages, none of them very large, and all of them disappearing quickly, a peculiarity which, if anything, enhances the significance which I have given them. They are the little leaks announcing that a greater break is not far off."

An exactly analogous condition may appear in the delicate skin of the lower eyelid, and should, therefore, be designated recurring subcutaneous ecchymosis. The spots are only a few millimeters in length, of a slightly purplish hue, resembling a small bruised area, and, like their congeners in the conjunctiva, they come and disappear quickly. They undoubtedly have exactly the same significance. Indeed, in one case I have seen the subconjunctival and subcutaneous ecchymoses alternate. It is unnecessary to dwell further upon this subject, except again to emphasize the importance of observing changes in the subconjunctival and episcleral vessels and their relationships to

serious widespread general vascular disorders, and therefore to chronic Bright's disease.

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Treatment of the Nervous Phenomena in Chronic Nephritis.

BY JAMES M. ANDERS, M. D., LL. D.

Following an early recognition of chronic Bright's disease, a carefully selected hygienic regime may at times retard, or even arrest the morbid process of the disease. This statement has special reference to the removal of ascertainable causes as well as of the various aggravating conditions and agencies. The subject of the hygienic management of chronic Bright's disease, however, cannot be considered here, save only the dietary, which exerts an important influence upon the origin and course of the nervous symptoms.

In all stages of the affection, a suitable diet must be formulated for individual cases, but unfortunately clinicians are not entirely unanimous as to what forms the best alimentation in cases of chronic nephritis. In the presence of marked gastric irritability, an absolute milk diet may be necessary, and also during acute exacerbations of chronic Bright's, but under all other circumstances it is not advisable to restrict the food to milk alone. In the first place, it furnishes an insufficient amount of carbohydrates to the system. It is a matter of common observation that under the influence of an exclusive milk diet in persistent albuminuria, the albumin eliminated is oftentimes increased. In my experience, an undue general weakness is prone to result from long continued restriction to milk.

A mixed diet, in which the more digestible vegetables and fecaline articles play a prominent part, is perhaps best adapted to a great majority of the cases. The effect of the diet upon the condition of the patient and also upon the urine must be carefully noted from time to time.

Another objection, and in my opinion one quite generally unappreciated, to an absolute milk diet is that the ingestion of massive quantities of fluid by overfilling the bloodvessels, increases markedly the blood pressure, and hence, also, as a necessary result, the work of the heart—an already overburdened organ. It is entirely unnecessary to dwell before this audience on the unfavorable ulterior effects of an early overhypertrophy, or to emphasize the well-known fact, that oncoming, secondary cardiac dilation is a danger signal of uremic manifestations, including the nervous phenomena. This is one way at least in which the diet of a nephritic patient may act indirectly as a cause of the nervous symptoms, due to uremia. I quite appreciate the fact that I have encroached upon debatable ground and it must be confessed that it is not definitely known how much fluid, in the form of milk or other liquid articles of food, can be ingested *per diem* without harmful effects in the manner indicated above. It is probable that in any case more than three liters of fluid would increase the blood tension to an injurious extent. *Per contra*, I desire to declare myself in favor of the use of an abundance of fluids, especially milk, within the bounds of safety to the cardiovascular system. My principal point is that the one consideration which must never be omitted is the preservation of the integrity of the cardiovascular system, particularly the heart. This organ must on no account be overlooked.

It has been pretty generally claimed that a too generous diet of solid proteids may occasion uremia. On the other hand, Hale White found experimentally that less albumin is passed in chronic nephritis upon a full diet, than upon either a milk or a farinaceous diet. Contrary to the general impression, this observer found that a full diet was not more liable to lead to uremia than any other. The observations of Dujardin-Beaumetz and other investigators, however, indicate that under the influence of an exclusive animal diet, the quantity of albumin eliminated in twenty-four hours is nearly doubled. This view has been widely accepted. Chronic nephritis has been developed in a dog by exclusively nitrogenous food and absence of exercise, and according to Adami, similar conditions produce nephritis in man. It

will be seen, therefore, that an appropriate dietary must exercise an important prophylactic influence as regards the nervous and other phenomena of the disease.

The treatment of existing nervous symptoms is purely symptomatic. Delirium, restlessness, nocturnal cramps and mild muscular twitchings call for sedatives, *e. g.* the bromides, after measures such as catharsis and profuse sweatings, aimed at the elimination of the excrementitious products, have been tried; or they may be combined with the eliminatives.

Uremia may present a grouping of features that closely simulates other brain conditions, as apoplexy, brain tumor, chronic mania and these must be carefully excluded before adopting measures appropriate in the nervous conditions of renal origin. In acute uremia the patient is usually found to be unconscious, and also suffering from convulsions, as a rule. If general convulsions have not occurred in the given case, it is well to give a prompt aperient, as, a drop or two of croton oil mixed with a small amount of olive oil, placed far back upon the dorsum of the tongue. Free action of the sweat glands must be obtained by the hot, wet pack, supplemented by the hypodermatic use of pilocarpine (one-fourth grain). The heart should be guarded by strychnine combined with digitalis. Diuretics are indicated but often fail us when used. Wet and dry cups applied to the loins are sometimes more effective than diuretics in securing diuresis. I have found dry cups used in this way to relieve renal congestion, and to be followed by an increased flow of urine. Quite recently I have seen a striking illustration of the efficiency of dry-cupping. These measures may promptly restore consciousness, but if not, then blood-letting from an arm vein is justifiable and is at times effective. A general convulsion is justly regarded as the most alarming nervous symptom of uremia and it demands promptness of action. The measures before recommended with a view to bringing about rapid elimination, both vicariously and through the kidneys are indicated and should be carried out, but while applicable during the convulsive seizure, they are not sufficiently speedy in their action to cut it short. Not a moment should be lost in resorting to the various agencies that will control or arrest the convulsions. The choice of the remedy should be governed by the patient's previous condition, more particularly the state of the arterial tension. I hold that there are few cases met with in which substantial benefits and often speedy relief is not secured by

venesection. It is especially serviceable in cases in which the patient is a robust individual with a full, high tension pulse and congestion or cyanosis of the face. There is a considerable group of cases that present the indications of a comparatively feeble, or even dilated heart and correspondingly low arterial tension, although the walls of the accessible vessels may be of calcareous hardness. Now, there is no concealing the fact that in these cases it becomes a difficult problem to decide whether venesection from the arm should be practised or not. I am so strenuous in my advocacy of general blood-letting in this condition, that I would urge the adoption of an axiom, "When in doubt, bleed." The effect of free bleedings is often striking and almost instantaneous. As a rule, cardiac stimulation and that energetic stimulation should be instituted when the pulse becomes small and feeble, as often happens after free venesection. Among heart stimulants, I give the preference to digitalis, strychnine, strophanthus and the hypodermatic injection of camphor. We often see in this as in other diseased conditions, natural efforts directed to the elimination of the poisons of disease; they follow "the course that makes for health." Hence, it is manifestly the duty of the physician to take cognizance of these and lend assistance wherever practicable. These active natural eliminative efforts in uremia may be reinforced by the injection of normal saline solution. Again, there is no more favorable occasion to produce this therapeutic effect than after a portion of the contaminated blood has been removed by venesection during a convulsion. The normal saline solution, which should be administered intravenously, not only promotes the activity of the emunctories and gives new vigor to the heart, but also serves to dilute, and hence to weaken the force of the peculiarly potent toxic material, circulating in the blood.

In this connection the question naturally emerges, "Is the administration of opium or morphine allowable in chronic nephritis," or in other words, "Does the use of these agents aggravate the uremic manifestations in this disease?" The balance of the testimony of a trustworthy character is probably in the affirmative. It impedes the action of the vicarious channels of elimination (skin and bowels, as a rule, and also interferes oftentimes with the establishment of free diuresis. Again, the somnolence produced by morphine is readily confused with that due to uremia itself. Extended experience, however, dictates that it is less harmful in its effects in acute nephritis than in chronic,

more particularly in the cirrhotic form of the disease. Indeed, it is a popular method of treatment in the uremic convulsions belonging to acute nephritis. In chronic nephritis it should be employed only—and I refer now to the more alarming symptoms—after other measures including jaborandi and venesection have failed or are contra-indicated by great enfeeblement of the circulation. It should be stated here that some years ago Stephen Mackenzie advocated the use of morphine in uremic convulsions and since then not a few clinicians have employed it, claiming excellent results. Osler speaks highly of its use “in the dyspnea of Cheyne-Stokes breathing of advanced arteriosclerosis with chronic uremia.” Chloroform by inhalation is also a capital remedy in the convulsions of uremia and yet as compared with the favorable impression made by free bleedings, it plays a subordinate part. Its effects are less permanent and less pronounced, since it has not the power of removing retained waste products of metamorphosis from the body of the patient.

In bleeding an uremic patient we are wisely aping the mechanic who, when he discovers that his vessel has been overburdened, because of some defect in its construction, and finding himself powerless to remedy the same, orders the removal of a certain portion of his cargo. Availing ourselves of this analogy, we may also readily see how in the case of uremic convulsions, general blood-letting not only diminishes the required force of the human piston, the heart, but also the activity of the toxic substances in the circulating medium upon the nervous centers. Chloroform, however, is distinctly of sufficient importance as a remedy to be recognized in the treatment of uremic convulsions. It has the important advantage of being readily and quickly applied. Usually uremic convulsions speedily produce an exhausted condition of the tissues in general, and hence it cannot be too strongly pointed out that when the blood is laden with noneliminated poisonous matters, the condition is desperate in the extreme and all of the most powerful agencies that promote their elimination, as well as the arrest of the convulsive seizure, must be promptly although rationally employed.

Cerebral hemorrhage (apoplexy), which is dependent upon high arterial tension, is to be treated as under other circumstances. It is often preventable by unwearied attention to the vascular system, it being especially important not to permit any great increase of tension in atheromatous vessels. The best remedies to lower blood-tension are

nitroglycerine in ascending doses, potassium iodide and sodium nitrite. The latter preparation is too much neglected. Unless illy borne, the potassium or sodium iodide are better adapted for prolonged use to diminish blood-pressure, than nitroglycerine and sodium nitrite. To meet the indication in a sudden marked increase in the blood-tension, nitroglycerine is the remedy of choice, on account of its promptness of action.

When a hypnotic is needed, sulphonal, trional and chloralose are the best remedies and are to be preferred to the opiates. In the familiar headaches associated with renal disease, temporary relief only is possible, as a rule. The cause may be multiple. I have sometimes been able to relieve them by careful restriction or regulation of the diet. In some cases the headache is of a severe type and accompanied with much depression. It is then usually of uremic origin. The prophylactic measures recommended before must not be overlooked. Among remedies directed to the pain, phenacetine (five to ten gr.) combined with caffeine (two or three gr.) in capsules, every third hour until relieved, have given much satisfaction in my hands.

DISCUSSION.

DR. S. D. RISLEY said that the more that is known about chronic Bright's disease, the more complex it becomes. Although it cannot be confined within definite, sharp limits, a group of cases studied from the standpoint of ophthalmology may be divided, as Dr. de Schweinitz has already classified them, into (1) exudative and hemorrhagic manifestations in the retina and choroid and (2) the degenerative changes. He referred to 2 cases illustrative of these types of the disease. He referred to a case of subconjunctival hemorrhage in a young man with chronic Bright's disease. He strongly urged that when such changes are revealed an examination of the urine should always be made, and if negative at first repeated daily examinations only should satisfy the physician. He also referred to a case in which the ophthalmoscopic examination showed changes indicating Bright's disease and intracranial disease. The urine of this patient contained an abundance of albumin. He had been trephined for fracture of the skull and autopsy showed a large abscess of the cerebellum.

DR. DAVID RIESMAN said that the subject of subconjunctival hemorrhage, is one to which all should pay a great deal of attention. He recalled 3 cases in men 49 and 50 years of age; one of whom had albuminuria and the other 2 had arterial disease. The nervous manifestations of chronic Bright's disease first came to his attention when he was acting as Pathologist to the Philadelphia Hospital. There a comparatively large number of cases came to autopsy, with the diagnosis hemiplegia. In a number of these the brain was entirely normal, except for some edema of the membranes, but in every one in which

the brain was normal kidney disease was present and the cases had been called uremic hemiplegia. These facts made such a profound impression upon some of the clinicians that they went to the other extreme and sent cases to autopsy diagnosed uremic hemiplegia in which cerebral hemorrhage was found. It is evident, therefore, that diagnosis, even in the best hands, between hemiplegia from organic brain disease and that from uremia is extremely difficult. Personally, he has never seen hemianesthesia in the condition, but the literature shows that it is sometimes present. Monospasm and aphasia are other local manifestations. In 29 cases, 15 were unassociated with any other symptom than aphasia referable to the brain. The diagnosis was only made by prompt recovery and the presence of urinary signs of Bright's disease. In addition to the other symptoms of Bright's disease that suggest brain tumor he mentioned mental confusion bordering on mania or on melancholia. In such cases the diagnosis is extremely difficult; they are found in the Insane Department of the Philadelphia Hospital. Two illustrative cases were reported. Insanity is another nervous manifestation of Bright's disease about which one cannot speak with certainty. The statement of the alienists is that Bright's disease does not cause chronic insanity; but he thinks he has seen cases in which insanity was due to kidney disease. He described such a case.

DR. L. WEBSTER FOX said that 3 or 4 years ago attention had been called to subconjunctival hemorrhage by Berger, of Paris, who said it was one of the preliminary symptoms of Bright's disease. Examinations in the Medico-Chirurgical Hospital Out-patient Department had shown about 20 odd cases. Each proved negative at the time, but a careful following of the cases showed that 6 or 8 had developed Bright's disease subsequently. The same condition exists in the minute macular hemorrhages or in the small miliary hemorrhages extending over the fundus beyond the equator of the eyeball. He referred to a paper by Dr. D. D. Stewart on the subject in which the early inflammatory conditions of the minute capillaries were mentioned. Stewart regarded these as the forerunners of Bright's disease. Since reading the paper of Dr. Stewart Dr. Fox has followed such cases. He has found them not so frequently among hospital patients as among private patients of the better class; a number of whom eventually developed Bright's disease. He believes, therefore, that there is a pre-existing stage of Bright's disease unrecognizable except by the microscopic examination of the blood, a stage which an examination of the eye or the urine will not show. In Dr. Fox's experience the prognosis in conditions of hemorrhage with choroid degeneration is very unfavorable and the life of the patient limited to a short time. With the choroid degeneration without hemorrhages the life of the patient is prolonged. Reference was made to one case, a patient who had been under observation for 7 years before death took place.

Dr. H. A. Hare said that many cases of obscure diagnosis have been cleared up as soon as a neglected examination of the urine has been made. If it is a fault of the medical profession that, as a rule, it is too careless about urinary examinations, he thinks it also true that it is too careless about *repeated* examinations. The cases most apt to mislead are those in which albuminuria is a very inconstant symptom. In a case seen within

the last 10 days the urine had been examined no less than 6 times within a short period, giving no sign of albumin. The facial expression, the character of the skin and of the heart sounds were indicative of Bright's disease. Three specimens of urine examined in the 36 hours just previous to the death of the patient showed albumin. Concerning the question whether cases of acute unconsciousness are due to injury, to cerebral growth or to uremia, the case of a saloonkeeper, who had gotten up in the night, walked to the head of the stairs and was found lying unconscious at the bottom of them, was cited. The family thought the fall had caused concussion of the brain. The urinary examination showed hyaline casts and considerable albumin. This, with the subsequent history, convinced Dr. Hare that uremia was the cause of the fall and of the unconsciousness. The presence of Gunn's vessels pressing upon the veins had proved in Dr. Hare's experience to be a valuable diagnostic sign. It is indicative of arteriosclerotic change and points to the treatment that is needed. Against the cases of inconstant albuminuria are seen cases of quite profuse constant albuminuria which do not seem to be associated with acute renal disease. He referred to a patient in whom this condition had been present for 12 or 13 years. In many of the cases in which the ocular symptoms seem most grave and in which it would seem that life must end within 6 months or a year, life is prolonged. He agreed, however, that in the presence of albuminuric retinitis death usually occurs in a year or 18 months. When it is impossible to determine the cause of the albumin, Dr. Hare suggests that estimates of the urea be made. A low percentage should raise suspicions of Bright's disease. He is in accord with Dr. Anders that it is not necessary to regulate the diet as rigorously as in the past. The institution of an absolute milk diet he thinks unwise, and the giving of skimmed milk still more unwise, for this is deprived of its fatty material which, in not too large quantities, is beneficial. The red meats he considers no more harmful than white. He does not agree with Dr. Anders that the injection of large quantities of liquid increase the arterial tension. In one of the laboratories in Leipsic, he stood in the presence of the great Ludwig and heard him state the well-known physiological fact that one might inject large quantities of fluid into the veins without causing rise of the blood pressure. About 3 times as much salt solution as there is blood in the vessels may be injected before the arterial pressure is raised. The hot pack, while exceedingly valuable is regarded as sometimes having a depressing effect upon the heart. Pilocarpine, once used with a great deal of enthusiasm, is now to be administered with caution because of the pulmonary congestion it may produce, so that the patient is drowned in his own secretions. In Dr. Hare's own experience in cases in which he had found it difficult to produce sweating by the hot pack alone, he had put the patient in the pack and used strychnine and pilocarpine simultaneously; strychnine to protect the heart from the hot pack and from the pilocarpine. He differs from Dr. Anders regarding the giving of sulphonal and trional believing that a dangerous condition of the urine is developed by full doses of these drugs. He was glad Dr. Anders had emphasized the point regarding the use of morphine. Investigation had shown that Loomis, of New York, only used it in the cases of acute uremia.

DR CHARLES W. BURE stated that he had made mistakes both ways in the differential diagnosis of uremic hemiplegia and that due to cerebral hemorrhage. If one were able to watch the case constantly diagnosis would be less difficult. In uremic hemiplegia the palsy varies or may vary from hour to hour. In organic palsy this does not happen. Bright's disease can simulate tumor of the brain in a most perplexing way. As to neurasthenia the term is largely a cloak for ignorance. True neurasthenia, a breakdown of nervous strength, caused by a congenital weakness and irritability of the nervous tissues is a rare condition. Much that we call neurasthenia is Bright's disease, or some chronic digestive trouble or even incipient phthisis. He thinks it will be safe to predict that the term neurasthenia will in a few years have gone out of use or be restricted to the only condition it properly includes, namely the result of a congenital weakness of the nervous system. Hysteria also is a much-abused term. Certainly not infrequently careful examination will reveal a cause for supposed hysteria and that cause is sometimes Bright's disease. Hysteria should be made to include only the true disease and not used as a scrapbag for queer cases. After all, in diagnosis tuberculosis, hysteria, syphilis and nephritis are the great diseases. A man knowing them knows differential diagnosis.

DR. A. A. ESHNER referred to cases of nephritis in which albuminuria is not constantly present, but in which it is often absent, even for long periods of time. In these especially the ophthalmoscopic findings may be of exceedingly great service in diagnosis, in disclosing not merely the presence of hemorrhages or degenerative lesions, but more particularly the condition of angiosclerosis. In conjunction with these lesions or in their absence one would have to pay attention besides to the general symptoms of nephritis, the condition of the heart, especially hypertrophy and accentuation of the second sound, with increased arterial tension, together with evidences of failing circulation, such as shortness of breath, edema, headache, vertigo, drowsiness or wakefulness. Related to these cases, but of less well-defined nature are those to which, for want of a better term, is given the designation renal inadequacy. In these cases there may be marked diminution in the amount of urine, likewise in the elimination of urea. They may be attended with symptoms indistinguishable from those of uremia and after death lesions of nephritis may be wanting.

DR. CHARLES P. NOBLE said that in many thousand examinations of urine carried out in routine hospital work during the past 13 years he had been surprised at the large percentage of apparently healthy people who had casts in the urine, and at the result of a little rest in bed with an increase of the water consumed, which was followed by their disappearance so that the patient would have no further evidence of kidney trouble. He had observed this in so many cases that personally he did not believe the finding of casts in the urine necessarily indicated Bright's disease, either acute or chronic. Casts are often caused by temporary irritation. For example, after operation, especially after operation on the kidneys, after indiscretions in diet, etc. At least 10% of all cases operated on by Dr. Noble have casts, and very few of them have Bright's disease. When the use of pilocarpine was first introduced in the treatment of uremia Dr. Noble had seen 3 typical cases of drowning from

bronchorrhea from one-twelfth grain of pilocarpine. He thought that when pilocarpine was recommended for uremia the condemnation should go with the recommendation. If used it ought to be used in very small doses and with very great care. Theoretically, decapsulation of the kidney as a cure for Bright's disease should offer something in the increase in circulation in the kidney. Without doubt removal of the renal capsule and allowing the kidney to form new adhesions and secure new bloodvessels should improve the circulation of the organ. Therefore, in cases of persistent nephritis resisting medical treatment it should be tried. Personally he failed to see how the operation could alter the changes which take place in the bloodvessels and in the heart and he felt that one would have to be optimistic to expect the concomitant conditions and secondary results of Bright's disease to be cured by operation on the kidney itself. A most important point is that the operation should only be done after the failure of medical treatment. Otherwise many cases of kidney irritation would be operated upon, which would recover spontaneously, and thus an erroneous opinion of the value of operation would result.

The Etiology of Gastroptosis.

BY ALBERT P. FRANCOISE, A. M., M. D.

[Read October 22.]

Clinicians seem at last to be in a position to give a more complete and definite answer to the question: "What is gastroptosis?" than has heretofore been forthcoming. Since the earlier writings of Virchow, Chluposki, Kussmaul, Landau and others in Germany upon abdominal displacements; and Glenard's monograph in eighty-eight upon gastroptosis, followed by the papers of Cheron, Féréol, Pourcelot, Trastour and others in France, much interesting and serious investigation has been devoted to this subject both in France and Germany, and more recently in this country, with the result that we are now reaching a position from which to dogmatize. To within the past few years there have been wanting the results of systematic, clinical and post-mortem study of these cases and it is only from such data that we can crystallize our views and give to the various physical signs and theories which have from time to time appeared, their true value. Since the post-mortem studies of Niesel, Ebstein, Sandifort, Hertzfeldt, Eberle, Legroux, Cuilleret and others, and the published clinical reports of Meinert, Langerhaus, Arneil and Steele and myself, we approach this subject from a point of view other than that of pure theory or a limited

personal experience, and it is only by the elimination of these latter two viewpoints and the sifting of data furnished by a large series of carefully studied cases that we can hope to place the study of this phase of stomach disease on a basis with that of more exhaustively studied lesions like those of the lungs and the heart.

It should be borne in mind that in discussing gastropotosis it is not possible to separate this condition from entertoptosis or a general splanchnoptosis, and that these conditions in their etiology and clinical manifestations complement each other. The author has been led to choose gastropotosis for a title rather than a more general term because in his opinion the symptoms which manifest themselves are best considered as due to or associated with displacement of the stomach.

Definition.—Gastropotosis may be said to consist in the descent and dilation of the pyloric end of the stomach and the downward displacement of the transverse colon, especially the right half and the hepatic flexure. The right kidney is usually movable, sometimes both kidneys; occasionally the liver, and exceptionally the spleen.

Gastropotosis may be distinguished as primary, where there is descent and dilation of the pyloric end of the stomach only, as is usually seen in women; or secondary to general dilation of the stomach where a primary gastrectasis by stretching and thinning the walls leads to a secondary ptosis. This is frequently the type in men. It may be congenital consisting in a persistence of the embryonal or fetal position of the abdominal viscera, as for instance in young children; or acquired, in the sense of being a retrograde movement in adult life to the fetal position of the viscus.

Etiology.—The question of etiology is the most difficult and obscure that the clinician is called upon in this connection to discuss. From the time of Virchow's early descriptions of abdominal displacements, in 1853, to the present time, theories for the pathogenesis of this condition have been rife and it will be necessary to mention for completeness' sake the most noteworthy of these. The earlier writers, notably Virchow, in Germany, and Glenard, in France, maintained that splanchnoptosis was the result of adhesions between the different viscera exerting mutual traction. These adhesions were, in their opinion, the result of localized areas of peritonitis and were often overlooked clinically. More modern research has found this theory tenable in only a limited number of cases. Virchow attributed great importance to coloptosis as a primary factor in displacement of the

abdominal viscerae and thought the transverse colon descended most frequently, the hepatic flexure next and the splenic flexure least frequently. Glenard's view closely resembled this, *i. e.*, that the right half of the transverse colon and the hepatic flexure sank first and that the stomach followed from traction on the gastrocolic ligament. That this condition did not always obtain was shown by Niesel, who in one hundred autopsies found the hepatic flexure in its normal position in thirty-four. The descent of the liver and kidney followed subsequently to the gastroptosis in Glenard's opinion.

The question of dislocation of the liver cannot be overlooked as an etiological factor of importance in enteroptosis and consequently in gastroptosis. From the difficulty of diagnosing this condition ante-mortem it does not occupy as conspicuous a position in this connection as it probably deserves. Post-mortem records show that it is not infrequent and in our series, of five cases operated upon, the liver was movable in two, or 45 per cent. General causes constricting the thorax, or pleural effusions pressing down the diaphragm would tend to dislocate the liver, with the addition of disease of that organ itself increasing its weight. Carstens, of Detroit, from the analysis of the literature of ninety-eight cases concludes that it is nearly always caused by injury, severe falls, heavy lifting, or, in a few cases, malignant growth in the organ itself. From a study of these cases, tight-lacing and pregnancy would seem to deserve mention. Landau, agreeing that enteroptosis was the first factor in gastroptosis, thought that disease of the abdominal walls, relaxation or loss of tonicity was directly responsible for the former condition. Hemmeter admits this view in a restricted number of cases, but agrees with Rosengart in emphasizing the liver as the central figure in enteroptosis. Hemmeter, Langerhaus, Kuttner, and most recently and convincingly, Rosengart, explain splanchnoptosis as being congenital in origin and believe that the condition itself consists in a reversion of the abdominal viscerae to an embryonal or fetal type. Kussmaul practically agrees with this view but describes two principal causes for this condition, the one heredity and the other tight-lacing. Ewald, Landau and Kusster do not believe in the congenital theory; while Schwerdt, Stiller, Fricklinger and others suggest heredity as the principal factor with constitutional abnormalities or taints, as for instance, phthisis and consequent rapid emaciation as directly responsible. Opolzer and Rollet agree that rapid emaciation is an important factor, and the latter lays particu-

lar stress on direct pressure from enlarged neighboring organs, especially the liver and spleen.

Tight-lacing has many advocates as being responsible for gastrop-tosis in a large number of cases in the female sex. Von Ziemssen believes that the pyloric end of the stomach is in this way pushed downward and to the left, producing the so-called vertical position of the stomach as first observed in autopsies by Meckel and subsequently described clinically by Kussmaul. Curveilhier, Chapotot and Valker lay great stress on the corset as a cause of gastrop-tosis, as do Einhorn, Kellogg, Dickinson, Morris and others in this country. Ebstein does not consider it a particularly important factor, though more recently both Meinert and Wiersker have supported this theory.

It is generally agreed that anything which constricts the thorax or enlarges the capacity of the abdomen tends to bring about ptosis of the abdominal viscerae. Meinert is strongly in favor of this view and claims that faulty development of the thorax brought about by a series of generations of malhygienic clothing, occupation or disease, especially a tendency to rickets, is frequently responsible. He is to this extent a believer in the congenital theory though in his opinion it is not so much a question of heredity as of faulty development. Lichtenstern has been more specific in this matter and claims that the muscular ligaments of the colon are weak and suggests incomplete descent or abnormal development of the cecum and great length of the mesenteries as important factors. Rosenheim practically agrees with these views. Some of the French clinicians, notably Charcot and Bouvert, consider gastrop-tosis secondary to neurasthenia. In 1894 Meinert, from the study of gastrop-tosis in chlorotic women, came to the conclusion that the former condition was an etiological factor of importance in the production of the latter. His views in this matter were not generally accepted, though his name has been frequently associated with this class of cases. It remained for Kelling, in 1896, to dispute finally and convincingly this view, and our series of seventy-five cases in which only one was chlorotic bears out Kelling's conclusions. Gastrop-tosis is usually unaccompanied by chlorosis, though the reverse is not true, as frequently chlorotic girls suffer with gastrop-tosis. The proper etiological relation between chlorosis and gastrop-tosis, as between the latter condition and neurasthenia, is properly expressed in stating that neither one is the direct cause of the other, but both are probably synchronous manifestations of some con-

stitutional weakness or anomaly. Each of these conditions can and does exist separately, and if chlorosis or neurasthenia does lead to gastroptosis as may be the case in certain instances, it is of course by reducing the muscular tone and resistance of the subject.

It should be clearly recognized then that there are two sets of factors in the etiology of this condition, *i. e.*, the conditions predisposing to enteroptosis, and those directly responsible, or the exciting causes. As predisposing causes may be mentioned hereditary predisposition and constitutional weakness; while the exciting causes as outlined by Hemmeter may well be mentioned. Recognizing that the first step in the vicious gastroptric circle is enteroptosis, he accepts the five causes as given by Langerhaus and adds four of his own. Langerhaus gives the following: (1) Relaxation of the abdominal muscles, following repeated pregnancies, abdominal tumors, etc.; as fully described by Landau. (2) Hereditary predisposition to enteroptosis. (3) Pressure of badly fitting clothing, belts or corsets. (4) Chlorosis, as described by Meinert. (5) Nervous dyspepsia. Hemmeter recognizes this last as a clinical entity, and thinks that it may lead to enteroptosis by inducing loss of fat and consequent weakening of the abdominal walls. He adds the following: (6) Displacements of the female genito-urinary organs. (7) Curvature of the spine. (8) Enlargement and increase in the weight of the liver by neoplasms, etc. (9) Traumatism.

From the above critical survey, it will be seen that the pathogenesis of gastroptosis is not a simple matter nor one readily disposed of. However certain general causative factors may be outlined and in the author's opinion it is neither wise nor necessary to try to formulate a theory that will be broad enough to explain all cases. For it must be admitted that very different exciting causes, upon which we can frequently lay a finger, are active in different individuals; and that in a certain measure each case is a law unto itself.

Gastroptosis is much more common in women than has been generally supposed, and in nearly all women complaining of symptoms of gastric motor insufficiency the underlying condition is gastroptosis. In this connection it may be well to call to mind Meinert's dictum that a normal position of the stomach is the exception in the female sex. Stockton, Boardman Reed and others estimate gastroptosis as being present in more than 50 per cent. of women. Of thirty-five consecutive cases presenting themselves at the Medical Dispensary

of the University Hospital with symptoms of gastric motor insufficiency, gastroptosis was found in all. It is only just to add that the stomach in a certain number of women complaining of these symptoms is found to be normal both in size and position, even when diastasis and relaxation of the abdominal muscles exist; and that there is no good reason for supposing that in the ordinary healthy woman the stomach occupies other than the normal position. The same cannot in all probability be said for the intestine and Virchow has stated that slight dislocation of the viscera, especially enteroptosis of mild grade, exists more frequently than not.

With regard to the relative frequency of gastroptosis in the sexes, our series showed fifty women and fifteen men, Arneil's figures were sixty-nine women and eleven men, while Einhorn, out of 340 cases, found 277 in women and sixty-three in men, showing that the proportion is approximately four or five to one in favor of the female sex. It is more common in women who have borne children and in whom the abdominal walls are pendulous and relaxed, and in whom diastasis of the recti muscles exist (Webster). It occurs frequently, however, in young nulliparous women in whom the recti muscles are closely approximated. It is probable that race or color have no influence upon this condition though statistics are wanting on this point.

Gastroptosis exists at all ages, but the greatest number of cases are noted in early adult life. Quoting from our series, the following are the ages with the relative frequency of its occurrence in the decades:

Under 20, 1; 20 to 30, 24; 31 to 40, 16; 41 to 50, 18; 51 to 60, 2; 61 to 70, 1; over 70, 1.

The youngest was a girl of eighteen years, and the oldest a man of seventy-one. The Medical Service from which the above series was computed did not afford the opportunity of studying the condition in children, the number of cases under twenty years of age being very limited. From the above figures it will be seen that the greatest number of cases occurred in the third decade, and that speaking more broadly, gastroptosis may be said to be discovered most frequently between the years of twenty and fifty. It is, however, found in early childhood and Hemmeter has reported three cases, two in female children of ten and twelve, and one in a boy of eleven. It was from a study of cases in children that Kussmaul based his belief in the theory of the arrest of development in the fetal state of the viscera. It should be observed, however, that gastroptosis is found much more

commonly in adult life than in childhood, which would go to disprove the theory of arrest of development as being very generally applicable. Offsetting this, however, is the fact that it frequently exists without symptoms so that it may be present and undiscovered in many cases until some added factor gives rise to symptoms.

Congenital tendency and heredity, faulty development, pressure from enlarged organs or those the seat of tumors, tight-lacing, the corset, etc., have all been mentioned above in connection with their more prominent advocates. Muscular weakness, especially following prolonged illness is put down as a cause of gastroptosis. Gastroptosis not infrequently follows the infectious fevers, especially typhoid fever and scarlet fever. A certain number of cases are seen in narrow-chested, rachitic children from this cause. Rapid loss of weight is generally admitted as being very important etiologically, and is most frequently seen in cases of phthisis or severe asthma. Gastroptosis sometimes results from the artificial reduction of weight in obesity.

The effect of severe attacks of coughing in chronic disease of the lungs, pleuræ or bronchial tubes may give rise to splanchnoptosis in those otherwise predisposed. Collapse or fibroid contraction of the lung with consequent reduction in the size of the thorax, or large pleural or pericardial effusions depressing the diaphragm as instanced by Rosengart, are factors in the pathogenesis of this condition, acting chiefly by primary dislocation of the liver. Dislocation of the abdominal viscera, especially the liver and kidney, may occur as the result of physical shocks and jars, sudden strain or muscular effort. Persons of weak muscular organization are more prone to abdominal ptosis than others; in such, overwork or prolonged fatigue may lead to it. In this connection certain occupations might be suggested. Gastroptosis is frequently found in anemic and delicate saleswomen who stand six or eight hours a day, and in women of like mould who are called upon to do arduous household duties, especially washing. In our series, several cases occurred in motormen and conductors on trolley cars, in whom the upright position and the jarring of the cars, considered in connection with irregular and too short periods for meals, suggest themselves as possible etiological factors. One case occurred in an instructor in the University; and came on suddenly after playing tennis for two afternoons when unused to violent exercise. He had previously had few or no gastric symptoms.

Weakness or loss of tonicity of the abdominal muscles following repeated pregnancies has been emphasized by Landau. Too early

rising from childbed or the omission of the post-puerperal binder may also give rise to this condition. Hernia of the mesentery in the linea alba, as mentioned by Rosengart, may lead to it. Large abdominal tumors or cysts, ascites and frequent tapping and laparotomies may all, by destroying the integrity of the abdominal wall, act in the same way. Exhausting hemorrhage is put down as a cause; and gastro-intestinal auto-intoxication, as instanced by Langerhaus. Webster, of Chicago, in 1901, called attention to the separation of the recti muscles as being an important factor etiologically. This is nearly always present in multiparous women and without doubt plays an important role in destroying the integrity of the abdominal walls and disturbing intra-abdominal pressure. Diastasis of the recti muscles does not, or with extreme rarity, exist in nulliparous women or in men, so it cannot be claimed to affect this class of cases. I have seen marked diastasis of the recti in a woman who had borne thirteen children and who suffered with symptoms of gastric motor insufficiency but in whom there was no ptosis of the stomach whatever. Anything which changes intra-abdominal pressure has been considered a cause for enteroptosis as it is for displacement of the uterus.

Indiscretions in diet are a very widespread and potent factor in the pathogenesis of gastropptosis; overloading the stomach with either food or drink, irregular and bad habits of eating, whether by inducing gastric motor insufficiency and gastro-intestinal auto-intoxication, or by acting more directly and mechanically through a primary dilation. There can be no doubt that many cases, especially in men, are brought about in this way. Tobacco is also a factor, and the author has seen marked cases of gastropptosis coming on rather acutely in medical students who have smoked to excess, and in whom irregular habits and late hours have also played a part. Primary gastrectasis by stretching and thinning and consequent atony of the walls of the stomach leads to a ptosis of that organ for purely mechanical reasons and in these cases the ptosis must be considered secondary to the dilation. (Steele.)

It seems probable that we should recognize a distinction in the form of gastropptosis occurring in the two sexes. From the study of this phase of the subject the author is lead to the opinion that primary gastropptosis, *i. e.*, when the ptosis is primary and the pyloric end of the stomach is secondarily dilated, occurs most typically and frequently in women as pointed out by Steele, while secondary gastropptosis, *i. e.*, where the ptosis is secondary to general dilation of the stomach, is the form more commonly seen in men. The figures from

our statistical review of this subject, afford interesting data in this connection.

Gastroptosis with pyloric dilation only (primary gastroptosis); women, 48; men, 7.

Gastroptosis with general dilation (secondary gastroptosis); women, 2; men, 8.

In conclusion one must admit that the etiology of gastroptosis and its associated conditions is difficult to explain, and that many of the theories offered are purely hypothetical. We must recognize two sets of causes, the predisposing and the exciting. The former are congenital weakness and hereditary predisposition; and the condition itself is shown by anatomical and physiological investigation to resemble closely the state of affairs in the fetus, and hence may be spoken of as a retroversion of the viscerae to the embryonal or fetal type. Among the more common exciting causes are tight-lacing, rapid emaciation, disease of the abdominal integuments, or briefly, anything that constricts the thorax or enlarges the capacity of the abdomen. Enteroptosis or more specifically coloptosis is generally agreed to be the primary factor physiologically and to precede the gastroptosis. The kidney and liver follow subsequently. In other words there is a vicious circle in which the colon and hepatic flexure are first involved and secondarily the stomach and kidney. The tendency of the latest investigation seems to point to the liver as the primary factor in many cases of enteroptosis and there can be no doubt that it would be impossible for the intestine to remain long in place after dislocation of the former organ. Chlorosis and neurasthenia should be looked upon as manifestations of a common underlying cause, supposedly constitutional weakness or faulty development, rather than as direct causative factors.

Preliminary Report upon Experiments to Determine the Pressure in the Bile Ducts in Floating Liver.

By J. DUTTON STEELE, M. D.

[Read October 22.]

The occurrence in the Medical Dispensary of the University Hospital of a case of chronic jaundice that, at first, was thought to be dependent upon gastroptosis and which, at autopsy, was found to be

caused, to a large degree, by a floating liver, led the writer to make a study of the literature of the latter condition. This was found to be considerable and the reported cases of total hepatoptosis amounted in all, to about 100. In forty of these the diagnosis was confirmed by operation or autopsy. Among these forty cases it was found that a large proportion suffered from colic-like pains similar to attacks of gall-stone colic, though in only about one-fifth of them were gall stones discovered, at autopsy or operation. About one-third of them had attacks of jaundice accompanying the pain and without the appearance of gall stones. In other words, almost all the verified cases of floating liver showed symptoms of obstruction of the bile duct.

The writers upon the subject, if they attempt to explain these symptoms at all, state that the obstruction is probably caused by kinking or torsion of the ducts due to the displacement of the liver, but apparently none of them have ever done more than speculate upon the matter. The subject appears to have some clinical importance as well as scientific interest. A series of experiments has been undertaken to determine whether or not, downward displacement of the liver can cause obstructions in the bile duct, and to ascertain, if possible, the character of this obstruction. These experiments have given fairly positive results, and this preliminary report is intended to place these results on record.

A study of the reported cases confirmed by observation upon the cadaver, has shown that the varieties of hepatoptosis can be classified briefly as follows: First, total hepatoptosis, in which the liver has dropped from its normal position so that its contact with the diaphragm is no longer preserved. The posterior edge is firmly held in place by the coronary ligament and the vena cava. The portion of the liver that drops, is that supported by the suspensory ligament, so that in downward displacement of the liver we have a dropping of that portion of the organ which is supported by the suspensory ligament, while the posterior edge remains firmly attached in its original position, about the tenth thoracic vertebra. It will be seen that this condition of affairs can be easily reproduced experimentally, by cutting the suspensory ligament.

Another form of hepatoptosis, is that known as anteversion. Here the anterior edge drops as in total hepatoptosis, while at the same time the posterior edge rises so that the liver preserves its contact with the anterior half of the diaphragm and the anterior abdominal wall,

while in total hepatoptosis the anterior edge and the superior surface of the liver is not in contact with the diaphragm and falls away from the anterior abdominal wall. In either case the relations of the liver to the bile duct are practically the same.

The experiments, which were two in number, were performed upon human cadavers, since it is obvious that observations upon the lower animals would be valueless and misleading, as the whole subject depends upon the relation of the liver, gall bladder and ducts in the human subject.

The technique was as follows:

A glass tube was tied in the gall bladder and the duodenum was opened so as to expose the papilla. A small glass tube was tied in the entrance of the common duct while a rubber tube led from it outside the body, so that the flow of fluid through the duct could be observed without great distortion of the parts. From the gall bladder rubber tubing led to a utensil holding a salt solution whose specific gravity represented the specific gravity of bile. This was raised and lowered by an assistant so that the required pressure could be obtained. In this rubber tubing a "T" tube was inserted, which connected with a manometer graded in millimeters so that the pressure could be read in terms of the fluid used.

The first subject experimented upon was one in which a marked degree of floating liver existed; in the second subject the liver was normal in position.

The experiment consisted in measuring the pressure required to force fluid from the gall bladder through the ducts into the duodenum, with the liver in different positions imitating those seen in total hepatoptosis. This was done by cutting the suspensory ligament and allowing the liver to sink to different levels.

The results of the experiment will be given in detail in a later paper and it is sufficient to say, that when the anterior edge of the liver was at the umbilicus the pressure required to force fluid through the ducts was four times as great as that necessary when the liver was in its normal position, and that the pressure varied directly with the dropping of the anterior border of the liver.

The second part of the experiment, determining the position of the obstruction has as yet given no positive results, but it is hoped that a study of the anatomical relations of the parts will do much to indicate the seat of the obstruction.

The results of the experiment have been to show that there is some definite obstruction to the flow of bile through the cystic and common ducts in downward displacement of the anterior border of the liver. According to Landois even slight stagnation of the bile will lead to its absorption and jaundice, and clinical experience has taught us, that the stopping of the flow of bile through the ducts gives rise to increased peristalsis behind the seat of obstruction and colic-like pains of the type familiar in closure of the ducts from the impaction of gall stones. A study of the reported cases shows that these colic-like pains often accompanied by jaundice and without the occurrence of gall stones are of very frequent occurrence in floating liver. The result of operations in these cases has been in a great majority of instances to entirely relieve the pain and jaundice. The inference to be drawn from these facts, as taken in connection with the result of the experiments is, that there is a definite obstruction to the flow of bile through the cystic and common ducts in downward displacement of the liver, and when this is sudden and complete it gives rise to symptoms resembling impaction of gall stones. The reason why in floating liver the symptoms of closure are intermittent and not continuous is probably that the parts accommodate themselves somewhat to the abnormal position of the liver and that the obstruction is brought about by some sudden increase in its displacement, as after heavy lifting or some severe exertion. Clinical experience, as revealed in reported cases, shows that to be the case.

DISCUSSION.

DR. ALFRED STENGEL believes the subject of gastropptosis and its etiology of more than theoretical interest because it involves an explanation of the bearing of the condition upon neurasthenia and other nervous diseases. His experience is that the condition is exceedingly common in women, and is present in about 60% to 70% of the women he has examined. A sharp distinction, however, should be made between gastropptosis capable of producing symptoms, and that which can be demonstrated by dilation of the stomach and by other mechanical means. Gastropptosis of all kinds he believes to be dependent largely upon physical conformations of the body, such as narrowness of the lower part of the chest and a greater length compared to breadth and thickness of the body. In young boys and men of this physical construction he has seen the condition much more frequently than in men of better construction. The wearing of belts in young men he believes contributes to the severer grades of gastropptosis by causing a downward pressure of the intestines. Gastropptosis in its severer grades, in his experience, has been found in women of the same physical type. He excludes cases of very marked gastropptosis due

to diastasis of the rectus muscles and to adhesions or to the downward direction of tumors or downward displacements of the uterus from pendulous abdominal walls, but refers to what might be called, in one sense, primary gastropptosis. He believes that there is some closer relation to neurasthenia than Dr. Francine seemed to admit, and that gastropptosis, or more properly, enteropptosis, is capable of producing the symptoms designated as neurasthenia. Neurasthenia, on the other hand, produces gastropptosis by causing a relaxation of the abdominal supports; not only of the abdominal walls, but the walls of the viscera themselves and the ligaments, the proof of which is found in the variability of the position of the stomach in persons suffering with the condition. In connection with this variability the mode of examination determines largely the amount of gastropptosis that will be found. If the stomach is first emptied by washing out and then filled it will be found that the pylorus rises. If the stomach is examined after it has been emptied this elevation does not extend to the same degree as when food is introduced. This applies also to the percussion outlines when the stomach is empty. Under these circumstances the pyloric end sinks to a lower level and appears to be of greater extent than it really is. With the stomach in the normal position a minor grade of gastropptosis, that which Küssmaul called the subvertical position of the stomach, will be found to exist. The fulness or emptiness of the intestines is also a contributing factor to be taken into account. In considering the treatment, and particularly the surgical treatment, it should be positively known that the condition present is the one causing the symptom. This must be inferred by the condition of the patient, by the behavior of the symptoms under varying conditions of the stomach. In regard to the crises of pain, more particularly taken up by Dr. Steele, he offered the following speculative explanation: It is quite conceivable that in movable kidney the pain is not due to torsion of the pedicle, but to pressure upon the duodenum. In one case he had seen it demonstrated that the kidney had pressed upon the duodenum so that the latter organ could not escape from the pressure, which might be injurious, and dilation of the stomach might result. With regard to the painful attacks he believes that displacement of the stomach should be considered as well as displacement of the kidney and liver.

DR. H. D. BEYEA said that, including his own cases, 15 cases had been operated upon by gastropexy. The operation is applicable only to severe cases. Three varieties of operative procedure have been devised; first, the elevation and fixation of the stomach to the abdominal wall; second, the shortening of the ligaments; third, the elevation of the stomach by increasing the abdominal pressure. Seven cases have been operated upon by the first method; the first, by Treves, in 1895. The patient, a woman of 25 years, had hepatopptosis with more or less adhesions, and was greatly improved after operation. Reference was made to another method practised by Coffey, of Portland, Oregon, and reported recently in the *Philadelphia Medical Journal*, by which the stomach is suspended in a hammock made by the omentum. The method was criticized by Dr. Beyea because any operation that would fasten the stomach to the abdominal wall would hinder its normal movability and produce painful symptoms. In one case operated upon in New York by this fixation method, the

patient suffered, after several months, from pain and vomiting. The operation of shortening the gastrophrenic ligament is the method to which Dr. Beyea calls particular attention. He described an illustrative case and said that he has done 2 other operations. Behr, of Geiswald, did a similar one. Altogether, 8 cases have been operated upon, 7 of which Dr. Beyea has been able to study, and the results have been good. All have gained in weight. The advantages of the operation over fixation are that the normal movability is retained, there is no possibility of adhesions, with a percentage of danger of 0.25%. In connection with this method the operation for the repair of separated rectus muscles, devised by Webster, is recommended.

DR. MORDECAI PRICE referred to 4 or 5 cases of severe dilation and displacement of the stomach seen within the last 4 years. All were pronounced to be gastropptosis and treated by some of the very best men. In every one there was almost complete obliteration of the pyloric orifice of the stomach. Some of the patients were able to eat for days and weeks without regurgitation, and then the whole quantity taken into the stomach would be regurgitated or vomited. In all of them gastro-enterostomy was done and recovery ensued in all. All of these patients also had suffered excessive pain. After the disease has progressed to some extent Dr. Price thinks it probable the cause of the pain lies in obstruction at the pyloric orifice. He has often been surprised to find the excessive amount of contraction present.

DR. JOHN MADISON TAYLOR believes that irregular and excessive feeding in infancy is a common cause of the various visceral ptoses, and particularly of gastropptosis. Many reasons can be given showing that the foundation of gastropptosis can be thus laid, and he thinks the subject well worthy of special study.

DR. JAMES TYSON said that Dr. Taylor had referred to a point which he had had in mind, more particularly in the case of adult men. He is quite sure that in a few cases gastropptosis is caused by enormous eating, the weight and distention of the large amount of food ingested being quite sufficient to cause the stomach to move downward. It is evident that there are a number of causes for the condition, and he agreed with Dr. Stengel that the conformation of the body has very much to do with it. Tight lacing he believes favors the production later of gastropptosis by altering the position of the stomach by pressing the liver toward the left, which carries with it the pyloric end and causes the stomach to assume a more vertical position. In women who are compelled to stand a great deal, who are obstinately constipated and in whose colons accumulate large amounts of fecal matter the condition is likely to develop. He believes also that congenital tendencies co-operate in producing the condition.

DR. FRANCINE in closing said in regard to Dr. Price's question that without doubt pyloric obstruction is a very important factor in the production of gastropptosis; but that the later condition is, of course, secondary and the case should be considered and treated as one of pyloric obstruction. Some of the worst cases are seen following pyloric obstruction and come under the head of those produced by mechanical causes. Dilation, atony and retention follow and these factors are quite sufficient to explain the condition on

mechanical grounds. He agrees with Dr. Taylor in thinking that gastroptosis may exist more frequently than supposed in infants and young children, and that probably the condition is laid here which under the strain of later life is discovered as fully developed gastroptosis. He regards the indications for operation in a doubtful state. The cases of Dr. Beyea he agreed were subjects for operation, but in his experience so much relief is afforded by lavage, diet and mechanical support, that the number to be referred to the surgeon is small. In that connection Dr. Stengel's remark about the effect of the ptosis itself was very important. If gastroptosis is limited to mean simply a ptosis of the stomach, its significance is not clear. But it is usually taken to include the symptoms of gastric motor insufficiency as well. If the ptosis itself is producing symptoms this is an indication for mechanical support; and where this is unavailing, possibly operation. He has frequently seen cases in which the ptosis is quite marked, yet in which lavage, suitable diet and a few drugs directed to combat fermentation, gave absolute relief to the symptoms, unaided by any mechanical support whatsoever. In these cases it is apparent that the ptosis itself is not directly responsible for the symptoms. The effect of the ptosis upon the symptoms in the condition recognized under the term gastroptosis, Dr. Francine regards as a question of extreme importance in the successful treatment of these cases.

Diseases of the Rectum a Specialty.

BY HERMAN A. BRAV, M. D.

[Read October 22.]

The rapid progress in medicine and surgery during the latter part of the last century brought about the so-called specialties. The accurate knowledge required in each specialty is so vast, that it makes it impossible for the general practitioner to master them all. This circumstance created a desire among physicians and surgeons to select a certain branch of Medicine or Surgery for their life work. While most of the specialties, as Ophthalmology, Gynecology, Obstetrics, Pediatrics, Orthopedics, Neurology, Otology, Laryngology, etc., have all established their well-deserved reputation in this country as well as in Europe, there is one important province of practice which has not as yet received recognition by the profession at large, but has been highly appreciated by those suffering with diseases of the severest kind, which secretly impair and undermine the constitution and involve a degree of personal distress. The specialty I am alluding to is Proctology. There is a consensus of opinion regarding this specialty.

Some claim this specialty is confined almost exclusively to quacks, who have been practicing it from time immemorial with their nostrum remedies; others again think it absurd to be a pile specialist. This latter claim probably derives its origin from the fact that patients who present themselves for rectal treatment all say: "Doctor, I have the piles." It is to be regretted that the patient's statement is often taken for granted even by experienced physicians, who either from lack of knowledge or lack of professional duty, fail to discover the pathological condition of the rectum. In a paper read before the North Branch of the County Medical Society last January (see *American Medicine*, March 15, 1902), I had occasion to quote several such cases which were thus erroneously diagnosticated. It is a matter of deep lamentation that cases of faecal impaction of the rectum and sigmoid flexure which have resulted in ulceration are only too frequently treated for intestinal indigestion or neuralgia; polypoid growths for hemorrhoids, hemorrhoids for prolapse of the rectum, stricture of the rectum for constipation, the reflex symptoms of fissure or ulcer for uterine, prostatic or cystic trouble, and malignant growths for bleeding piles. With these facts staring at us there is only too good reason to believe that the afflicted patients, having in many instances sought in vain for relief, have abandoned themselves to the unprincipled empiric, who after exhausting their scanty means has consigned them hopelessly to a miserable existence or a premature grave.

While I am radically opposed to the charlatan I must admit that he has contributed more toward the furtherance and advancement of rectal knowledge than any regular physician. Not by virtue of his knowledge, but by his devotion to this work he has awakened the profession from its deep lethargy, stimulating and spurring it to place this specialty on a scientific basis. The founder of this specialty was Frederick Salmon, Esq., M. R. C. S., of London, who noticing how very many persons in the humble walks of life were suffering from certain peculiarly painful and distressing diseases, founded an institution in 1835, which was called the Benevolent Dispensary for the relief of the poor afflicted with fistulæ, piles and other diseases of the rectum or lower intestines. Later on the title of St. Mark's Hospital was conferred upon the institution which name it has retained up to the present day. Since the foundation of the institution there have been treated at St. Mark's no less than 80,000 patients. During the time Mr. Salmon was connected with the Hospital he performed over 3,500 operations without a fatal result, an ample evidence of the good and efficient work conducted at St. Mark's. At the present time nearly every hospital in London has on its staff one or more rectal surgeons,

who devote most of their time to this particular branch of surgery. These men teach in various medical schools and impart their knowledge and experience to students, enabling them to treat rectal cases successfully when they enter into the arena of the medical profession. Continental Europe has largely contributed to the literature of this subject but the profession in general has not yet given it the attention its importance demands.

To verify my statement I will mention cases which Professor Hochenegg, of Vienna, related to me. On several occasions he has had cases of carcinoma recti referred to him for opinion and subsequent treatment by provincial physicians with the statement: "I suspect for a long time some serious affection of the rectum but since I have no speculum it is impossible for me to make a proper diagnosis." Gentlemen, in making a diagnosis of carcinoma of the rectum a digital examination alone will be sufficient and no speculum is necessary, as by the introduction of a speculum great damage may be done.

Some of these cases were treated for koprostasis and hemorrhoids for years. The best time to operate is in this way lost and if the surgeons cannot, despite their progressive technique show many permanent cures it is not their fault, because the patients are generally referred to them when the cases are too far gone. In our country two eminent men stand in the first rank as leaders in this specialty: Kelsey and Mathews have for many years been laboring most effectively in the advance of rectal knowledge. They have often called our attention to the many mistakes there are daily made by our faults to make a proper diagnosis. The profession, however, has not yet embraced this all important branch of practice and very little attention is paid the subject. I have only recently been called in to see a very healthy looking and robust man who was afflicted with internal hemorrhoids in the third stage of their existence, that is to say, piles which do not spontaneously return into the rectum but require manual reduction. The prolapse took place on slight exertion, such as standing or walking, as well as with every act of defecation. The patient suffered the most intense agony every time the bowels moved, but there was more or less distressing pain all the time. I suggested an operation, which the patient refused, on the ground that his former physician promised to cure him with ointments and opiates. He used diachylon and zinc ointment locally and internally, opium to prevent a bowel movement and so escape the intense pain connected with it. Nothing short of an operation will be effective in these cases and the sooner it is performed the better the result. I believe, palliative treatment should always be tried in the early stage of hemor-

rhoidal disease—certainly in all cases in which the piles are never protruded and also in the second stage when the protrusion takes place only at the time of defecation, and the piles return into the rectum spontaneously after the act has been completed. However, in such a case as the one mentioned, it is not only not advisable to try palliative measures, but I consider it a crime on the part of the physician to delay the radical cure by operation. No delay should occur, because the pain or distress that the patient suffers and the constant loss of blood, must of necessity reduce the vitality of the patient. Such weak and exhausted patients cannot be considered the most favorable subjects for operation and the final termination may not be a very satisfactory one; besides, the operation under such circumstances is attended with more or less danger.

It is true, that an accurate knowledge of rectal surgery and the skillful performance of rectal operations requires study and experience for years in this special branch, but there is no reason why the general practitioner should not be able to diagnose properly and treat successfully cases which may be relieved and in some cases cured by simple measures based upon scientific principles. It seems to me that the best way to drive the rectal quack out of existence would be the introduction of a special course of instruction in diseases of the rectum in our Medical Schools. Clinical lectures should be delivered in the following subjects:

1. A review of the anatomy of that part of the perineum which contains the anal aperture and to draw attention to the structure and pelvic relations of the rectum; because diseased conditions can only be accurately determined by comparison with the normal.
2. The surgical importance of a thorough knowledge of the physiology of the rectum.
3. General diagnosis.
4. The various methods of examination.
5. Various diseases of the rectum, their etiology, pathology, symptomatology and treatment, palliative and operative.
6. Various methods of operating.

Great stress should be laid upon the systematic examination of the rectum, because therein lies the secret of a proper diagnosis. Such a course of instruction will not only prepare the future doctor to meet rectal cases with confidence, but it will teach the public at large that this specialty belongs to the regular physician just as well as other specialties. I wish to emphasize this, because any one who has been in general practice even for a short time, must have heard the remark so often made by patients: "Doctor, I have some bowel trouble for which condition I used salves which I saw advertised, because I did

not think regular doctors treat such cases." We all recognize that rectal diseases are quite common and it may with truth be said that there are no more afflicting or distressing maladies to bear, or which are productive of more serious consequences; whilst it may be doubtful whether there be any branch of medical knowledge for the acquisition of which less facility has been afforded.

PROCEEDINGS
OF THE
Philadelphia County Medical Society.

The Existence of Typhoid Fever in Atlantic City.

BY PHILIP MARVEL, M. D.

[Read by invitation, November 12.]

Geographically speaking, Atlantic City is built upon an island, situated off the southeastern portion of the State of New Jersey, in latitude 39° 22' north, longitude 74° 25' west and is about fifty-five miles in a direct line southeast from Philadelphia.

The city proper is built upon the northeastern end of the island, and is removed from the mainland, seaward about five miles. The intervening distance between the city and mainland is an unbroken broad stretch of salt meadowland, except to the north and west, where it is broken by the Thoroughfare (Little Egg Harbor Inlet), Lake's, Absecon and Grassy bays.

The history of Atlantic City dates from 1852, but from this year until 1882 there is little known of interest relative to the subject of this paper; no record of any attention whatever having been given the question of sanitation until the latter year, at which time Dr. Boardman Reed, with other members of the profession, succeeded in organizing a Board of Health. The prejudice and lack of harmony in public feeling at the time served here, as elsewhere, to retard the Board in accomplishing much until the following year; however, they were resolute and determined men, with conviction no less strong than the dangers they had organized to combat, and shortly led others to realize the necessity for such an organization.

In 1884, acting upon the recommendation of the Board of Health, a sewerage system, known as the West system, was laid in the principal streets during this and the following year. Ordinance succeeded ordinance, recommending such legislation as would force property owners to connect their properties with the system, when the pipes were already conveniently placed. Year after year the pipes were extended in both old and new territories; properties provided with proper means of connecting, and public feeling, hitherto prejudicial, was largely overcome.

The placing of water pipes in the smaller houses and subsequently destroying the surface wells, has led to the entire removal of surface drinking water, and how well the Board of Health has succeeded in its recommendations to have all properties connected with the sewer system may be seen in the recent report of the New Jersey State Board of Health for 1901, in which is briefly told the story of how persistent and untiring have been the efforts of our Board. It is perhaps proper to incidentally state in this connection that no epidemic occurred in any of the unconnected districts previous to their being connected with the sewer, which fact doubtless was due to the strict and careful inspection that was given them. The following is extracted from the report: "Number of dwellings and tenement houses, 5,025; total number of dwellings connected with the water main, 4,550; total number of dwellings connected with the sewer system, 5,275." The seeming discrepancy in the foregoing figures, I take it, is that the first was intended to include only dwellings and tenements, of the latter there were twenty-five; and the last to include all the above, with the larger hotels, and possibly recently built houses, not yet occupied, all of which are compelled to connect. In all, there are now upward of thirty-five miles of sewer pipe in active service in Atlantic City. The sewage, with two exceptions, is directed to one common center, from which it is pumped through a thirty-inch iron disposal main to the Thoroughfare, a distance of two miles from the city. The average daily pumpage in the height of the season is five million gallons; for the remaining months, it ranges from two to three million gallons. The volume of water passing the outflow end of the sewage disposal pipe in twenty-four hours is estimated to be 800,000,000 gallons. The exceptions referred to, are a short run of pipe in the northern portion of what is known as the Moore Tract, a small, outlying district, north of the railroad, which drains directly

into Penrose Canal, and the northwestern portion of Chelsea, also north of the railroad and adjoining the back inlet, draining direct into the upper Thoroughfare.

The water supply of Atlantic City is from three sources, viz: (1) From deep artesian wells driven within the city a depth of 750 to 800 feet. (2) Artesian wells driven to a depth of forty to one hundred feet on the mainland, between six and seven miles from the city, the larger number of which are self-flowing. (3) From an inland lake situated in an almost uninhabited section of Atlantic County, two miles farther inland. The overflow from this lake is continually renewed by constantly flowing springs, situated within its basin, and a few tributary streams from cedar lowlands. A large portion of the water from the lake daily overflows a dam, constructed for that purpose. When required, this water is brought from the lake to the pumping station which is situated near the mainland series of artesian wells, through a narrow, open, artificial canal, made in the soil, the bottom of which is of white sand and gravel.

At the pumping station, the water from the lake is received with that from the driven wells, and pumped through a sealed iron main, a distance of five miles, to Atlantic City, to a standpipe, where a million or more gallons are kept in storage, being constantly replenished. The subterranean source from which the first series (i. e. the deep wells) draws its supply, according to the description given in the State's Geological Survey, is that of the well known 800 feet horizon extending N. W. to S. E. across the State, and is without possible pollution. The source of the second series, and also of the flowing springs, within the lake, has its beginning in the hill lands north of Hammonton, and filters through strata of fine white sand a distance of more than twenty miles, which is protected from the ordinary surface waters by a stratum of compact clay formation, between the six and nineteen foot perpendicular. The third, or lake supply of water, as stated by the engineer, is used very little except in the spring during the Easter holidays, and in the midsummer months—more particularly, July and August, when it composes less than two-fifths of the bulk supplied. Therefore the remaining eight months, the city water supply is almost entirely from an artesian source. The greater number of the larger hotels have their own artesian wells, and are neither dependent upon, nor required to use the city's supply. Analyses of these waters made by Drs. Leffman, of Philadelphia, and

Cooper, State Geologist of New Jersey, taken independently from the three sources, have shown each to be exceptionally pure and wholesome. They have specially spoken of that obtained from the artesian wells, remarking upon its freedom from organic matter. Indeed, that received from the lake, has so slight a percentage that it ranks much above the average spring and river supply. Whatever objections that might in the future arise from the use of the water from this latter source, will soon be removed, as the Water Commissioners have already in hand recommendations to put down more artesian wells, the depth of the second series, which, it is thought, will furnish a supply equal to, and greater than will be required for many years. Also, for the purpose of protecting the lake for possible future demands, a suitable portion is to be cleansed, dammed and properly protected for emergency supply, which supply will be brought through a conduit to the present pumping station and filtered.

The garbage is collected daily in covered wagons, made for the purpose, and removed to a plant on the meadows, a distance of a mile from the city, where it is incinerated. It must be admitted, however, to the discredit of the authorities having it in charge, that the collections have not always been made according to the requirements of the ordinance, therefore, the Department of Health has not been without numerous complaints during the months that the service was most taxed, but the increase of typhoid fever in the city the past summer and autumn, has served to impress the said authorities with the necessity for a more strict compliance than has hitherto been given to either individual complaints or the demands of the Board of Health.

The major part of the food supply of Atlantic City is drawn from Philadelphia, New York City, and the rural districts of Pennsylvania, New York and New Jersey, the most important exception being fish, which, in certain seasons of the year, are mostly taken from waters adjacent to this city. Deep water fish, however, and varieties foreign to these waters, except blue fish, are largely imported direct from the northeastern and southern markets. Oysters are brought from the waters of the Delaware and Chesapeake, and planted in the bays north and west of this city, varying in distance from four to seven miles, from where they are taken after proper growth to supply the city's market. The milk supply furnishes no exception to that of all large cities, being received from large and small dairies situated in various farming districts of this and adjoining States.

Having briefly referred to the sources through which typhoid fever infection usually finds its introduction into our homes, as well as our cities, before more particularly considering the investigation and report of the committee, appointed by the Atlantic City Academy of Medicine, to ascertain, if possible its source in Atlantic City, I wish to refer to some possibilities peculiarly arising from the special relation which this city bears to the sanitary condition of the country at large. This question, however, may be simplified by referring to that of Philadelphia and other large cities near by. It may not be a unique situation, but certainly an exceptional one, to find for eight or more months in the year a city of any number of inhabitants, its greater number being already accredited residents of other cities.

For instance, when Atlantic City has from 200,000 to 300,000 persons for its summer population, which represents but a temporary transfer of large residential portions of various thickly populated sections of the different cities there must necessarily come with this great aggregation of humanity a large importation of infectious disease and disease-producing germs. And again, the great and almost inestimable daily demands made upon the energies of those who have the responsibility of caring for this great army of health and pleasure seekers, rapidly exhausts their stored energies, and leaves them with lessened resisting force, thus providing a suitable fallow ground for the development of infectious diseases. A study of this aspect of Atlantic City's position, will show without further argument, how very likely such an influx from so large a district as the "whole country," would disturb both the physical and sanitary conditions of the city and the wonder is that it has not hitherto had many epidemic outbreaks of typhoid and other diseases—certainly no better or more potent argument can be used as evidence of the faithful guarding of the city's health in the past, than the absence of epidemics, as verified by reference to the records of the city's Board of Health.

In 1882 Atlantic City's population was in round numbers 7,000; maximum daily number of visitors, in the summer, 40,000. In 1892, number of residents, less than 20,000; maximum daily population in August, visitors, 100,000 to 125,000. In 1902, resident population, not more than 40,000; maximum daily population in August, visitors, not less than 250,000. During the remaining months, from September to July, the number of visitors will vary from 20,000 to 200,000. By this unequal relation, Atlantic City's population is yearly

increased, and suddenly transformed from that of a village, to the number and importance of a great city. With the foregoing statements and figures before you I now come to the special discussion of the subject in question: The Existence of Typhoid Fever in Atlantic City.

Reference to Atlantic City's Board of Health records from 1885 to the present year, reflects the condition of the city's past and present health more nearly correctly than can be presented in any other way. From a study of these records, which are complete, with the exception of from 1888 to 1894, I am able to make the following statements:

During the years of 1885 to 1887, inclusive, the number of typhoid fever cases reported was 19. The largest number reported for any one year, 13; the smallest number reported, 3, being an average of 6 1-6 for each year. Population, resident, 6,000 to 8,000; visiting, estimated, minimum, 5,000, maximum, 50,000; average about 25,000 to 30,000. From 1895 to 1901, inclusive, total number of cases reported, 208; greatest number reported for any one year, 48 cases; smallest number reported for any one year, 18 cases; being an average per year of 29 5-7 cases. Population, resident, 20,000 to 35,000; visitors, 150,000 to 250,000. If we study this report in divisions, making the first include all cases reported between January and June of each year, inclusive; the second, all reported between July and October, inclusive; the third, all reported between November and December, inclusive, it forcibly demonstrates the period of the year when the largest number of cases have been observed. In the first division were reported 50 cases, or 1 1-6 per month. In the second division, 123 cases, or 4 1-28 per month. In the third division, 25 cases, or 1 11-14 per month.

It is to be regretted that the records do not indicate in all cases whether resident or visitor, hence any study of the reports looking to the correct estimate of the number infected in this city cannot be accepted as reliable, and in no case is it stated how long the individual was in the city previous to being stricken with the disease. That quite a number of the visitors including "imported help," (which I desire to emphasize later), are included in a number that should be exempt from the records, must be admitted without question. For instance, no case developing the disease within ten to twelve days after arriving in the city should be accredited to causes prevalent here and

there is great reason for doubt as to whether in many cases, the incubation period should not be more frequently placed at twenty rather than a less number of days. In support of the former statement I cite, as an incident in question, four patients attended personally this summer, each of whom developed the disease respectively on the first, third, fifth and seventh days after their arrival in the city; and these were reported simply in the regular way. It is not only probable but an unquestionable fact that the same is true of cases attended by my colleagues and other physicians of our city. To return for a moment and briefly allude to the cases observed among "imported help." It may be stated without argument, that these include a number of hospital cases. If the total number of visitors, who have been ill of typhoid fever in Atlantic City, be added to the number of cases treated among the help, to which reference is above made, and this number deducted from the total number of cases reported to the Board of Health, there would be quite another and a different showing; and again, if one could only know how many of these cases brought the infection with them, and to this number add the number of cases among our own residents, who whilst visiting other cities, in which the disease is prevalent, have become infected, we should have, I dare say, but a small percentage of the number recorded to Atlantic City's credit.

This brings me to the year 1902, when the circumstances are somewhat changed. Early in the month of August it became quite apparent to members of the profession that the typhoid bacillus had found a nidus within our city, and was propagating rapidly and effectively. Frequent discussions were had upon the subject and much careful thought and patient search given the investigation. In the early part of September, at a meeting of the Atlantic City Academy of Medicine, the subject was openly discussed, and subsequently a committee was appointed by the Academy for the purpose of a thorough investigation. So careful and effective had been the work previously done by individuals that the committee's task was much lightened, and resolved itself largely into a review and affirmation of that already done. After having considered the various sources of likely infection, as alluded to in the beginning of this paper, the committee having exempted one source after another, finally found evidence which pointed strongly but circumstantially to the hapless and innocent oyster. It was sure of having located at

least one source of infection, but before making the report, Dr. A. C. Abbott, Professor of Bacteriology and Hygiene, in the University of Pennsylvania, and Dr. Henry C. Leffman, Professor of Chemistry in the Woman's Medical College of Pennsylvania, were asked, as experts to examine the sources under investigation and pass upon the report before the same was submitted. This they did and it now bears their approval and signatures. (For a detailed report those who may be interested are referred to *The Philadelphia Medical Journal* of November 1, 1902.) "Fattening cribs," scarcely more than 500 yards from the point at which the sewage was accidentally, owing to a break in the disposal pipe, being delivered into Penrose Canal, were so situated as to receive the flood tide as it flowed through the canal to the Thoroughfare. Only ignorance could excuse men from so culpable a violation of sanitary law.

A similar, though much less dangerous condition, because of the small amount of sewage delivered, was found to exist in Gardner's Canal, an artificial creek, but a short distance west of the mouth of the Inlet. The findings of the committee were at once presented to the Board of Health, with the recommendation that an ordinance be prepared to include all of the adjacent waters around and about the city, within a radius of three miles, and that any person or persons found planting, catching, "freshening" or "fattening" any shell fish, whatsoever, within these waters, or offering for sale any shell fish known to have been taken from these waters shall be judged a violator of law and severely punished by fine and imprisonment; this to be passed by Council and made active at once. It remains to be seen what knowledge exists of reasonable evidence of the transmission of the typhoid bacillus to the oyster. This again is without direct proof, but a number of cases, quite a half-dozen, I should think, are known to have had typhoid fever for periods respectively varying from one to six weeks, from whom all the excreta were daily permitted to enter the sewer, without the least attempt at disinfection. These being unrecognized, it is only fair to infer that they did not represent the whole number who may have been treated by these same gentlemen without proper disinfection. And again, it was true of many patients that they did not consult a physician for several days after the beginning of their illness. And also, that simultaneously with the stopping of the offering for sale, of oysters "freshened," and clams caught in the sewage polluted waters, the further development of cases of typhoid has ceased with few exceptions.

It would be easy to further multiply evidence quite as probable as the foregoing, but it is unnecessary; that the infection was there, is not disputed. The question is, Whence did it come?

In accordance with statements and inferences already before you, the way to a probable explanation readily opens. Having recently addressed the following letter to the Health Boards of the large cities on and adjacent to the Atlantic seaboard, I am in possession of information bearing upon the subject of typhoid fever in these cities, which enables me to show the possibility that not only did the typhoid infection come from these sources, but also that a number of cases attributed to Atlantic City (some of which developed there and others after their arrival home) are in fact wrongly placed at the city's door. Not having stated in my communications to the several Boards, that I desired the information for public print, I reserve the privilege of withholding the names of the cities addressed, and the numbers individually reported; but I may state that the aggregate number of cases enumerated in the reports received amounted to nearly 10,000 cases already reported in these cities this year. From all of these cities, to my personal knowledge, Atlantic City's past summer population was materially increased. The following is a copy of the letter:

"To the Secretary of the Board of Health of ————.

"DEAR SIR: I am endeavoring to ascertain whether typhoid fever has materially increased the past three years in the Atlantic Seaboard cities, and the cause of the same when known. To assist me in obtaining this information, I am taking the liberty of addressing to the various Boards of Health, the following questions relative to it, and in so doing may I enlist your co-operation to the extent of answering the following, viz: The number of typhoid fever cases reported monthly for years 1900, 1901 and 1902, and

"What was the source of infection, if known?

"Thanking you in advance for your trouble, and courtesy I am asking, I am,

"Yours very truly,

"PHILIP MARVEL."

I hope I have not been misunderstood in the foregoing, and certain it is, it has not been my intention to in any way mystify the

subject, or exempt Atlantic City from any part of a relation in the recent development and distribution of typhoid fever infection within its boundaries, therefore, in concluding permit me to recapitulate briefly.

First: The existence of typhoid fever as was evidenced by the greater number of cases observed, was known to the profession in August.

Second: Though unofficially, the profession used its earnest and early endeavor to apprehend the source.

Third: The Atlantic City Academy of Medicine officially appointed a committee on September 19, with full authority to investigate, and if possible to determine, the source of the infection.

Fourth: The said investigation was successfully made; committee's deliberations examined and approved by two experts, and the report accepted by the Academy.

Fifth: A copy of the report was furnished the Board of Health with the committee's recommendations, and was favorably received.

Sixth: Said recommendations were duly prepared, presented and acted upon by the Board of Health, and to-day are an operative law.

Seventh: The knowledge acquired by the committee, within and without the city, was to positively exempt the water and milk supplies from contributing in any way to the source of infection.

Eighth: The knowledge obtained through the courtesy of the various Boards of Health, and the peculiar relation of the sanitation of Atlantic City to that of the larger cities of the country, makes it more than probable that Atlantic City was the victim rather than the source of the disease.

DISCUSSION.

DR. A. C. ABBOTT said that he thought the position taken by the Atlantic City Academy of Medicine highly commendable. There has been no suppression of facts, on the contrary, every effort has been made to discover the cause of the trouble. Through the courtesy of the committee having the matter in charge Dr. Abbott is thoroughly conversant with the investigation, and he has no hesitancy in believing that most of the cases of infection occurring at Atlantic City during the past summer are referable to the cause mentioned by Dr. Marvel in his paper. In cases of this kind it is rare that direct proof of the exciting cause of the sickness can be produced; this case is not an exception to that rule. The circumstantial evidence, however, is of the most convincing character, and leaves little doubt that the cause of the trouble has been discovered and eliminated.

DR. J. M. ANDERS said that the published report of Dr. Marvel is of great interest to the entire medical profession of the country, and of especial interest to the members of the medical profession of Philadelphia; inasmuch as Atlantic City owes its original reputation as a health resort to Philadelphia physicians. He feels also that Dr. Marvel and his colleagues are to be congratulated upon the prompt and thorough manner in which the investigation has been made, and more especially upon the results obtained, the finding of the source of infection—the oyster. With the publication of this report he believes there will be conveyed to the profession of the entire country a feeling of confidence that the profession at Atlantic City is able to cope with epidemics of infectious diseases even of obscure origin. He believes that the average duration of the incubation period of typhoid fever is probably longer than is generally supposed.

DR. A. B. HIRSH said that the report of Dr. Marvel shows the value of a community paying close attention to what may be said as to its health conditions by the hygienists living in that community. This report is in strong contrast with what has occurred in one of the Western seaports, where the effort of political as opposed to scientific influence has been to hide the prevalence in that center of a very serious outbreak of a peculiarly malignant disease.

SYMPOSIUM ON CHOLELITHIASIS.

[November 12.]

Some Phases of Gall Stone Disease with Especial Reference to Diagnosis and Treatment.*

By D. D. STEWART, M. D.

This paper deals with the general subject of cholelithiasis, more especially calculous cholecystitis and impaction of calculus in the cystic duct and the common bile duct; the etiology of calculus; its diagnosis and treatment. It is based on a series of cases in my practice, the history of a number of which is cited illustrating the diagnosis and treatment of *simple cholecystitis*, with and without obstruction of the cystic duct; *cholecystitis with hydrops*; *with seropurulent inflammation of the gall bladder*; a case of *pericholecystitis with adhesions, but without the presence of gall stones*; *cases of obstruction of the cystic duct and of the common bile duct* (the last by a massive calculus) with latent symptoms. Most of the cases cited were operated upon and thus the previous diagnosis was confirmed. Points in the special diagnosis of calculous cholecystitis and of common bile duct impac-

*Abstract of the paper.

tion by stone are dwelt upon. Emphasis is laid on the importance of careful interrogation as to a previous history of pain; the exact localization of pain; careful and repeated examinations of the patient, if not during, immediately after a seizure; on a mistake often made by the general practitioner in expecting to encounter jaundice with calculous cholecystitis; jaundice and pain may sometimes be absent even with stone in the common duct. Absence of enlargement of the gall bladder in impaction of the common duct by stone and the presence of enlargement with obstruction from without, as by carcinoma; the persistence and steady increase of the jaundice in the latter condition, and its variability in the former are valuable diagnostic points. To illustrate the difficulties sometimes attending the recognition of cases of cholelithiasis I cite several observed cases of simple gastralgia simulating recurring cholecystitis which might confuse, if one were not on the alert; cases, the diagnosis of which was confirmed by stomach examination and by treatment. An unusual case is related of pylorospasm with gastrosuccorhea, accompanying pyloric narrowing from presumed past latent ulcer, with a high grade of gastric dilation, which, with paroxysms of pylorospasm occurring only through the night, tended further to simulate gall stone colic; a case which had been for one and one-half years previously under treatment by several physicians for gall stone disease, and in which the diagnosis cited was immediately established by the use of modern methods of research and in which the disappearance of the gastralgic seizures immediately followed a resort to the stomach tube. I also cite a highly interesting case, from the diagnostic standpoint, in which there had been a long existing gastritis and several intercurrent attacks of the acute malady with recurring attacks of gastralgia, for all of which I treated him. Later while the patient was in another city acute pancreatitis developed, but was unrecognized, the seizure being unanimously diagnosed by his four attendants, three clinicians and one surgeon, at first as perforation from a gall stone, and subsequently, the patient recovering, as impaction from a gall stone. Section later revealed the true nature of the illness. In this case the previous history had been regarded by these attendants to absolutely establish the diagnosis of cholelithiasis.*

*That portion of the paper devoted to the treatment of cholelithiasis is read entire, since it received scant attention in the symposium on cholecystitis, in the February meeting. (Proceedings, Philadelphia County Medical Society, Vol XXIII, No. 1, p. 14.)

There is no solvent for gall stones in the gall bladder or in the bile passages. The employment of sodium cholate, of sodium succinate and sodium oleate, of the more rational sodium salts presumed to have some cholagogue effect, such as the phosphate and sulphate, of the old French mixture of ether and turpentine, and of chloroform, is no longer favored by the intelligent physician with the expectation of dissolving calculi in gall bladder or bile ducts. I confess that some fifteen years or more ago I was an adherent to the contrary notion and as a disciple of George Harley, for several years religiously saturated my gall stone cases with sodium cholate and the like, with the vain expectation of promoting solution and expulsion of the calculi. After a few years of increasing familiarity with the pathology of cholelithiasis, aided by the teaching of the operating and postmortem table, I became convinced of the futility of a solvent treatment. Treatment of active cholelithiasis is now justly very largely abandoned to the surgeon. There is no medical treatment for persisting dropsy of the gall bladder, or obstruction of the cystic duct, or seropurulent or purulent inflammation of the gall bladder, nor for stone long lodged in the common bile duct. But it is unnecessary, and the surgeon is usually unwilling to accept that we shift to him the cases of simple calculous cholecystitis, presumably without obstruction, cases such as those first cited, until after a fair effort to dissipate the ailment without the knife. If the patient is in a position to have the best done for him at home and, if necessary, to visit Carlsbad for a season or more, even though the attacks at first show a tendency to return fairly persistently, should they remain mild in character and should enlargement of the gall bladder not be evident on repeated examination, nor persistent sensitiveness, it is proper that such cases be not hurried to the surgeon. Medical treatment, however, is not to be instituted with the view to solution or extrusion of calculi, but with the object of both controlling the inflammatory, catarrhal process in the gall bladder and of preventing its recurrence, trusting with its abatement that the present calculi will no longer create trouble. It seems probable, as before remarked, that gall stones do not mechanically develop cholecystitis, whereby their presence is manifest. Our present knowledge of the pathology of that affection is against this old notion. It is also likely that only very rarely does attempted expulsion of a stone occur without a coincident cholecystitis, the latter, as Kehr remarks, being actually the force that initiates the movement of the stone. Cholecys-

titis is a very frequent condition and is far more frequently latent than active, for with presumably almost 10 per cent. of adults carrying these concretions, but possibly somewhat more than 5 per cent. of this very large number have recognizable indications of their presence.

Briefly, I should place the necessity for surgical interference in these cases of catarrhal cholangitis, without presumed obstruction of the duct, in this wise: If the patient is well-to-do, and can spend a season or two at Carlsbad; if there is no strong family history of carcinoma;* if the cholecystitis is recent and of mild type and shows a tendency to no persistent recurrence after some months of treatment, surgical intervention although not improper, may be regarded as yet unnecessary. Should there be an old history of recurring pains and the attack for which one is consulted suggests cholecystitis, I regard the case as immediately surgical for in such a one further recurrences are probable, and the likelihood of pericystic adhesions is strong. Concerning the question of necessity for surgical intervention in cases of stone in the common duct, my view is that these should be operated on no later than a month after jaundice has developed; since, with prolonged obstruction, and with so few if any adequate means at hand to promote passage of the stone, and with danger of complication so vital it is unmedical and unscientific to delay. A stone sufficiently large to completely obstruct the duct, after a month's impaction in the vast number of cases is lodged permanently, unless removed. No amount of oil or Carlsbad treatment, after this lapse, is likely to be efficient. Although jaundice may be temporarily diminished the stay of the stone will be uninfluenced, while, in consequence of the persistent back-pressure, gross pathological alterations in the liver structure are soon in progress. Hepatic cirrhosis is a not uncommon result of long continued biliary obstruction as are, under the influence of the cholemia, changes in the kidney. In the case of Mrs. D ——— although the stone shown you had probably not been carried many months, the liver already displayed indications of cirrhosis and a pronounced nephritis of presumed cholemic source was present. This case well illustrates the utter futility of medical treatment in a subject with stone of large size fairly long lodged;—the inutility of any drug, however active, as a stone solvent or as an aid to stone expul-

*The development of carcinoma of the gall bladder is favored by the presence of gall stones: about 14% of gall stone subjects develop carcinoma of the gall bladder (Kehr). Courvoisier found gall stones present in 87% of cases of carcinoma of the gall bladder, and Ames in 95.4% (quoted by Kehr).

sion. In this case accretion of the stone probably had occurred *in situ* since it may be regarded as too massive to have passed the cystic duct, without more marked symptoms than were originally present.

Other and not remote dangers of prolonged obstruction of the duct to be mentioned, are perforation of the duct and pancreatic disease, pancreatic fat necrosis and acute or chronic pancreatitis. Pancreatitis may follow very shortly after the lodgment of a stone in a situation to obstruct the duct of Wirsung. Cases are reported in which as stated by Opie (*American Journal of the Medical Sciences*, January, 1901) decided pancreatic lesions have followed, forty-eight hours after the onset of symptoms of impaction of the calculus, a period too short even for the production of marked jaundice. Although such cases are unusual the later occurrence of pancreatitis in consequence of obstruction is less so, and is, with other risks, one physicians must consider, not too long delaying surgical co-operation.

The one object in the treatment of simple cholecystitis is to endeavor to render quiescent the inflammatory process in the gall bladder and prevent rather than favor the passage of a calculus from that viscus. During and following the acute seizure active purgation must be avoided, as must the use of all measures which are presumed to have cholagogue effect. Under no circumstances even in the quiescent period must massage of the gall bladder or the gall bladder region be attempted with the idea of diminishing the size of this organ or of assisting to expel its contents. Should a gall bladder be palpable after an attack its duct is in all probability obstructed, and the only treatment is surgical. The risk of rupture of an inflamed gall bladder through massage is not slight. Morphine must be employed with the greatest caution in acute cholecystitis because of the danger of masking the local inflammatory condition, and because of the effect the drug may have upon the stomach, acting, as it so frequently does, to later enhance the already existing gastric irritability. Nausea and vomiting and pain, save when a stone is presumably already in passage, should be controlled by other means. Persistent nausea and vomiting in simple acute cholecystitis probably indicates that the calculus has already entered the cystic or common bile duct, and even if such is not the case, vomiting reflexly favors this.

In the treatment of a case of cholecystitis in the interval it is important to ascertain the condition of the motor and secretory gastric functions; and to appropriately treat any existing abnormality.

Chronic gastritis frequently accompanies cholelithiasis and, when the former is of mycotic origin, it favors the occurrence of the latter. The hygiene of the mouth should likewise receive attention, that infection of the stomach from diseased teeth or gums be obviated. It is held that gall stone suspects, irrespective of the condition of the motor or secretory gastric functions, should take food at short intervals, with the idea that stasis of bile in the gall bladder and resulting colics be thus rendered less likely. Clemm, of Darmstadt (*Wiener med. Presse*, quoted in *The Journal of the American Medical Association*, September 6, 1902) for instance, while stating that all catarrhal gastro-intestinal affections should be thoroughly treated, suggests that "there should not be more than two or two and one-half hour intervals between meals, with milk between at least twice," and that "a glass or two of milk should be taken before rising in case of the slightest suspicion of stoppage of the flow of bile," and that "the earliest and last meal should be principally albumin and fats." And Kehr, who is an advocate of frequent feeding, urges that a meal be taken on retiring. While it is true that during fasting the gall bladder acts as a reservoir for bile, and that frequent feeding favors its direct flow into the bowel, the risk of increase in gastric atony, should this exist, and of aggravation of the gastro-intestinal catarrh so often present, with transmission of this catarrhal process from the duodenum to the bile duct is sufficiently great to necessitate caution in the matter of very frequent meals. Feeding in this way is only indicated in those with well-preserved gastric motility, or with hypermotility and especially in such cases with hyperchlorhydria. The interval of meals should thus depend altogether upon the ability of the stomach to empty itself and largely upon the condition of the secretory function. In cholecystitis, as there is no interference with the passage of bile and pancreatic juice into the intestine and as the gastric secretory power may be normal, no very special diet is essential. The food must, of course, be plain and easy of digestion; high seasoning must be avoided, and rich entrées and pastry tabooed. No digestant is indicated if the gastric secretory power is normal and proper insalivation of the food is enjoined. In obstruction of the common duct, in which there may be coincident obstruction of the pancreatic duct, the diet should be largely albuminous and food into which the composition of starch enters, little if at all allowed. If substances containing starch are eaten, the starch

should be either first dextrinized or diastase should be administered. Pancreatic extract can be of little real value as a digestant if the gastric secretory function is normal or heightened, as destruction of the ferments in the stomach is certain, but with subacidity or anacidity, fairly frequently present in these cases, pancreatic extract may be freely given with meals to serve the triple purpose of an albumin, starch and fat digestant. It is then probably of more value, by virtue of its contained steapsin, than is the conjoint use of papain and diastase alone, which latter are practically without action on fats.

Gastric atony accompanying cholelithiasis is best treated by daily, morning stomach douching with alternate cold and hot water; weak sodium bicarbonate or Carlsbad salt solution in the hot water and sodium chloride in the cold—the last in preferably a weak quassia or calumba infusion. In all cases there is prescribed sodium sulphate either alone or in one of the Carlsbad combinations, such as the Carlsbad salt in powder or in crystal form* or Carlsbad water, or, what I prefer and have used for years, a combination of sodium sulphate and phosphate or of sodium sulphate, phosphate and bicarbonate. The salt is administered in rather hot solution on rising, subsequent to lavage, if this is practiced, a small quantity of bitter infusion such as quassia or calumba or of the tincture of nux vomica, taken coincidentally, renders the saline draught better borne by the stomach and stimulates its passage into the bowel. Movement and breathing exercises should be taken after its ingestion and no food is permitted for upward of an hour afterward. The solution should be drunk slowly and either in sips or in small draughts, at a few moments' interval, as its passage from the stomach is thus more rapid than if it has been hastily gulped. If the bowels are sluggish and a tendency to looseness is not set up by the Glauber salt I give a similar combination in smaller dose one-half hour before lunch, dinner and on going to bed, if food is not then taken. When sodium sulphate or phosphate is used more often than once daily and long continued the dose should not ordinarily exceed twenty grains to one-half dram of each. If hyperchlorhydria exists, sodium bicarbonate is omitted from the early morning combination, and a full dose (forty grains to one dram) given either alone or in combination with a small quantity of Glauber salt or sodium phosphate, three to four hours after the preceding meal and not

*The crystalline salt is more laxative, containing a much larger percentage of sodium sulphate than the salt in powder form.

later than one-half hour before the following one. The fluid extract of taraxacum or the succus taraxacum in one dram to two dram doses is coincidentally administered.

Abundant out-of-door exercise, tennis, horseback and the like, except in case of very recent active symptoms, is insisted upon. Too energetic exercise is not permitted when there is persistent sensitiveness in the gall bladder region or when there is a history of frequent recent attacks of colic. Energetic breathing exercises, general light massage, walking, hill climbing are all of utility in latent cases in stimulating the hepatic function and in obviating bile stasis.

If the trouble recurs despite carefully carried out treatment on these lines, and the patient is well-to-do and disinclined for operation—necessity for which not seeming too imminent—I advise a sojourn at Carlsbad. There, where business and family cares and social duties can be laid entirely aside and the life of the place becomes a pleasant incentive to recover health, much more may be accomplished on a similar régime than at home. A woman patient with chronic cholecystitis, whom I sent to Carlsbad three years ago and who was rid of recurring attacks by two seasons there, received approximately the following course of treatment: Before rising in the morning it was customary to sip a tumbler of hot Sprudel water. Immediately after rising gentle exercise was taken, such as walking about and dressing, and in fifteen minutes a second tumbler was slowly drunk, followed by a third one-half hour later. If the patient's strength permitted there was a considerable interval (upward of an hour) before breakfast, during which a rather active walk was indulged in. Breakfast was commonly very light, such as toasted bread and tea, the latter without milk and sugar. This was followed in two hours by a more substantial repast, minced chicken on toast. Two hours later minced ham or chicken with a purée of pea, potato or spinach was eaten. Three hours subsequently two tumblers of cold Sprudel water were taken with a lapse of one-half hour between, and in three-quarters of an hour after the second a meal similar to the last mentioned was indulged in. A tumbler of Sprudel water was finally drunk before retiring. There were, in addition, the inevitable peat poultices applied to the hypochondrium. A good deal of out-of-door exercise was insisted upon. A number of small gall stones were voided while at Carlsbad. Quite a similar line of treatment, substituting the Priessnitz compress for the peat poultices, had been previ-

ously attempted here but without much result, because of the lack of earnest and persistent co-operation of the patient.

The object of treatment in these cases of calculous cholecystitis is not to promote expulsion of stones, but to dissipate the underlying catarrhal process, and prevent its return, and, by maintaining persistent fluidity of the bile, to obviate further stone formation. Under the Carlsbad treatment and its modifications, however, small stones often are voided, leading the patient to imagine that he is thus rid of his trouble. If these calculi had not already engaged in the cystic or common duct their passage from the gall bladder is rather an unfortunate than a favorable circumstance since the extrusion into the duct of a calculus too large to be readily, if at all passed, may be similarly favored.

The treatment of recent cases of stone in the common duct belongs to the physician but for a short time only. Frequently the stone is passed into the bowel, entirely without treatment, a few days after the colic which has manifested its presence. In other cases the calculus may linger in the duct despite all that may be done to effect its dislodgment. In these cases of obstruction of the common duct, after the acute symptoms of obstruction have passed, I am in the habit of employing the sodium laxatives above mentioned and of resorting to the intragastric douche with warm sodium bicarbonate solution and of high enemas of hot and cold normal salt solution as before detailed, both for the purpose of reflexly favoring the onward passage of the stone into the bowel and of allaying the accompanying catarrh of the bile passages.

Formerly I was much inclined to the employment of olive oil in obstructions of the common bile duct by stone, and for several years used it rather freely with results which apparently justified my confidence in this remedy. In recent years I have employed it but little, largely because of the constantly met with repugnance of patients to the remedy and because of the difficulty in its retention by the stomach when administered in the full doses necessary,—and also, perhaps, because I became skeptical of its utility, cases not infrequently occurring in which passage of the stone because of its size could not be thus influenced. In recently reviewing my notes of several cases of common duct obstruction in which I employed oil some years ago, and in which there followed cessation of colic and passage of calculi of fair calibre (in one case a triangular-shaped

calculus the size of a beechnut was voided) I questioned if it was wise to entirely abandon this remedy. Naturally, oil can be of no utility in a case of massive calculus, but considering the paucity of our remedies, it is worthy of at least brief trial in recent cases of obstruction of the common bile duct, for if it can be of no utility, its employment is unattended with harm. In searching for an explanation for the mode of action of the oil, presuming the result sometimes obtained is not entirely a *post hoc* one, it occurred to me some years ago its utility might rest on a sound therapeutic basis (see my paper, "A Suggestion as to the Action of Olive or Cottonseed Oil in Gall Stone Colic; Observations on the Use of the Oils and Report of Cases," *Medical News*, November 23, 1889), and that there seemed reason to suppose the effect attributed to the oil might be due rather to a product of its chemical decomposition, glycerine. With unobstructed pancreatic flow it is not improbable that by virtue of the fat splitting ferment, steapsin, a portion of the oil is disassociated in the duodenum into its components, fatty acid and glyceryl, and that nascent glycerine, thus formed, exerts, in the duodenum, an effect somewhat analogous to that which takes place when glycerine is introduced into the rectum; withdrawing water, causing hyperemia and causing irritation of the afferent nerves of the part with which it comes in contact; thus leading to active reflex peristalsis. I believe that a similar effect might result from the presence of nascent glycerine in the duodenum as occurs from the introduction of glycerine into the rectum for its cathartic action. In my paper on this subject I remarked in effect that in addition to the active contraction which might be caused by the presence of glycerine in the duodenum, and which of itself would probably tend to contraction of the bile ducts and perhaps the gall bladder, that the power of diffusion possessed by glycerine perhaps would enable it to enter the common duct, and even the hepatic ducts and cystic duct, producing a similar depletion of the vessels there, and reflexly exciting the muscular fibers of these ducts to contraction. In consequence of this action an outflow of diluted bile would be favored which I thought would materially assist in expelling the stone. I said that since no other explanation is at hand as to the efficiency of the oil in these cases, and that, as is well known glycerine is normally so formed in the bowel, by aid of the fat splitting ferment of the pancreas and, since it is probable that glycerine can produce the effects

attributed to the oil, it is not unlikely that these are due to glycerine thus formed.*

Since the publication of my paper advancing this theory of the action of the oil, glycerine has been suggested in the treatment of cholelithiasis. If the utility of glycerine is as I proposed it would be useless as a remedy unless it could be immediately brought into contact with the duodenum without a stay in the stomach. Some trials which I made later with it in cases of impacted gall stone were without result.

Olive oil employed in the manner outlined in my paper is certainly worthy of a trial in recent cases of common bile duct obstruction by stone.

Preparatory Treatment Before Operation in cases of obstruction of the common duct by stone. Although this subject belongs rather to the surgeon, a few remarks here concerning it are not out of place because of its extreme importance. It is well-known that with persistent obstruction of the common bile duct, and, perhaps, as has lately been suggested, especially in cases involving obstruction to pancreatic juice flow the risk of uncontrollable capillary hemorrhage from operation is considerable. An effort should, therefore, be made to re-establish a flow of bile into the bowel, and to assist in the elimination of that already in the blood and the tissues. The line of treatment suggested in cases of impaction is of value here. I do not refer to the use of oil, but to the employment of daily lavage with hot soda solution and to the use of high enemas of hot and cold water as detailed in the case of Mrs. B ———. These last, in former years, were in vogue in the treatment of simple catarrhal jaundice, and are often of singular efficiency in promoting reflexly a flow of bile into the bowel. Lavage with soda solution acts similarly and perhaps also directly by diminishing the duodenal and bile duct catarrh. The laxative sodium salts are also employed for a similar purpose as outlined previously in discussing the treatment of cholecystitis, in the intervals. With these, taraxacum in full doses is prescribed. A morning laxative dose of sodium phosphate and sodium sulphate may be administered and nitromuriatic acid and taraxacum given one-half hour before the noon and evening meals and at bed time. The result obtained in the case

*Rosenberg (*Forst. d. Med.*, No. 13, 1889) about this time reported that he had found by experiments on dogs with gall bladder fistula that large doses of olive oil greatly increased the quantity and diminished the consistency of the bile excreted.

of impaction previously cited (Mrs. B——) under this treatment was quite remarkable, considering how firmly the large calculus was fixed in the duct by adhesions; bile appeared in the stools and the amount of urine was enormously increased. If with this treatment the stools remain persistently clay-colored, there may be reason to suppose that the obstruction is other than by a calculus. To also assist in the elimination of bile by the urine, when these remedies suggested have had little effect in directly promoting its flow into the bowel, it is worth while to employ benzoic acid or one of its salts—sodium or ammonium benzoate. Whatever its mode of action, that benzoic acid has an effect in hastening the resorption of bile from the tissues and its excretion is well established.

For a few days prior to operation after discontinuing the above medicaments, calcium chloride should be administered with a view to heightening the coagulating power of the blood and, if necessary during or subsequent to operation, parenchymatous injections of gelatine should be employed.

It is highly important that, following operation for chronic obstruction of the common bile duct, treatment be instituted to obviate, so far as is possible, the ill effects of the long standing bile stasis. The imminence of hepatic cirrhosis in these cases, must be borne in mind. Apart from this grave condition there usually exists thickening of bile ducts and often a chronic gastroduodenitis. In the liver structural changes have likely occurred due to the long existing back-pressure of bile and often to coincident infection. Even if not structurally damaged, liver cells long accustomed to the passage of bile into the lymphatics do not readily assume normal function, and, despite the removal of obstruction and free passage for the bile, bile still, for a more or less lengthy period, finds its way into the circulation. A continued observation of these cases is, therefore, of prime importance, in order to correct the gastric and bile duct catarrh, to obviate further bile stasis, and thus to restore the liver, as far as is possible, to its normal function. The state of the kidneys must also be carefully looked to.

The after treatment should be largely on the lines already laid down for the management of chronic cholecystitis. In addition mention must be made of the utility of certain other remedies in cases in which the jaundiced hue of the skin persists. Here, apart from the measures cited for the treatment of the catarrhal condition, and in

addition to attention to general hygiene, exercises, baths and local applications, I have found the persistent use of ammonium chloride and taraxacum of great service. I often alternate courses of ammonium chloride with nitromuriatic acid. My usual mode of administering these remedies is to employ a morning laxative of sodium sulphate or phosphate and to administer dilute nitromuriatic acid (ten to fifteen minims in fluid extract of taraxacum or taraxacum juice, one to two drams) before the midday and evening meals and at bedtime. Courses of ammonium chloride (fifteen to twenty grains three times daily) is alternated with the acid and is similarly exhibited in taraxacum, but is administered from one to three hours after meals.

Cholelithiasis.

BY JOHN B. DEAVER, M. D.

The gall bladder in man lies beneath the right lobe of the liver, pear-like in shape and, from its dependent position, favoring defective drainage. Except as a reservoir for bile it has no apparent use or function and when removed gives rise to no consequences whatever.

Its presence in the lower animals is subject to great variation. Most fish have gall bladders, the mackerel having none, however. It is absent in rodents, also in the camel, deer, elephant and horse, though the latter has a dilation in the duct between the liver and intestine. The cuckoo, ostrich and many of the parrots are devoid of a gall bladder. It may be absent in man, about fifteen cases having been reported. This variation and inconstancy would seem to show its lack of importance in the human economy.

The gall bladder is in relation with the hepatic flexure of the colon, the pylorus, the duodenum, the anterior abdominal wall and sometimes the great omentum. It is lined by a mucous membrane richly secreting mucus and which is thrown into minute folds, giving it a reticulated surface. The bloodvessels, lymphatics and the nerves form networks within the mucosa. The membrane at the cystic duct assumes a spiral form.

The secreting hepatic cells are transformed into epithelium at the margin of the lobule and emerging at the periphery pass into the interlobular connective tissue and by repeated union the hepatic duct is finally formed, which unites with the cystic to form the common

duct. The common bile duct passes between the layers of the gastro-hepatic omentum, behind the first part of the duodenum, joins the duct of the pancreas and, after running together for three-quarters of an inch, they empty into the posterior surface of the duodenum about three inches from the pylorus by an opening barely admitting a probe. Bile is secreted by the liver cells and passes through the ducts into the duodenum under low pressure. During periods of digestive repose it is forced into the gall bladder and flows out again when digestion is resumed.

Bile contains from 1 to 2 per cent. of bile acids which hold in solution considerable quantities of cholesterin. Cholesterin is a monatomic alcohol and is present in the bile in the gall bladder in from 0.1 to 1 per cent. and this is not increased when it is introduced into the organism experimentally.

Cholesterin is very widely distributed in the body. There is no proof that it is a product of hepatic metabolism, but it is probably eliminated by the epithelium of the bile ducts and gall bladder. It is found in large amounts in fatty degeneration of the spleen, kidney, etc., in tubercular tissue, carcinoma and sarcoma, and especially in infectious inflammation of both mucous and serous surfaces. It may contribute 7 per cent. of the total solids of pus. If from causes inducing stasis, the cholesterin becomes more concentrated one of the factors in the formation of a gall stone is supplied. If a catarrhal inflammation of the gall bladder takes place with the formation of an albuminous constituent from degenerated mucus and epithelial cells, with precipitation of the cholesterin and the production of bile salts, especially calcium bilirubinate, then the other factor is furnished and a gall stone is produced. We are thus led to the subject of cholelithiasis after this short discussion of some highly interesting problems.

Gall stones are very prevalent and postmortem records in Europe prove them to be present in from 5 to 10 per cent. of all Europeans, though of course only a very small percentage of these suffer any pain at all. Kehr states that about 5 per cent. of gall stone subjects suffer symptoms.

Among the etiological factors, heredity and occupation have little, if any influence on gall stone formation, though it is often stated that a sedentary habit is a factor.

Gall stones are rare under thirty years of age, though in a paper by Still four cases are reported and twenty cases in all collected from

the literature, of gall stones in young children. Schroeder places the percentage under thirty as between 2 and 3 per cent. The aged are more prone to gall stone formation owing to the retardation of the bile flow and perhaps the tendency toward calcareous degeneration to which the tissues of the old are susceptible.

Females are affected four or five times more often than men. This has been ascribed to pregnancy, corset wearing and the greater tendency of the sex toward ptosis, especially of the kidney. Naunyn's statement that "there is no indication that the influence of food or metabolism come into play as causes of gall stone formation" has not yet been disproven.

Some poisons, such as phosphorus, have an irritant action on the biliary passages and produce a congestion of their mucous membranes; but whether food products can also cause irritation of the ducts and so furnish a field for bacterial infection, has not yet been shown, at least so far as the writer has been able to find. Several theories relative to the amount of nitrogenous food ingested have been advanced but not proven.

This brings us to the most promising theory of gall stone formation and one that has been proven in numerous cases, viz.; bacterial infection. It has been stated that under favorable conditions there occurs a precipitation of cholesterin and a formation of bilirubin calcium and that a catarrhal condition of the mucous membrane with desquamation of its epithelium was the factor favoring these precipitations.

The catarrhal cholecystitis is due to an invasion of the gall bladder by bacteria, notably by the colon bacillus; the virulence of the infection deciding the extent of the cholecystitis.

The theory of microbic origin of gall stones was advanced as early as 1886, but Gilbert was the first to satisfactorily demonstrate the presence of organisms. At the Wiesbaden Congress, Naunyn accepted the bacterial origin of biliary infections and since that time numerous interesting observations have been published bearing on this subject. In 1897 Mignot and Gilbert and Fournier produced gall stones experimentally by inoculation with the bacillus coli communis and a few months later with the bacillus of typhoid fever. The last named writers divide cholelithiasis into two classes; those due to the colon bacillus and those due to the typhoid bacillus infections.

If then, certain conditions are favorable, such as biliary stasis or

a congestion of the mucous membrane of the gall ducts, the colon bacillus will ascend the ducts inducing a cholecystitis and aiding in the formation of gall stones. Some form of irritation must be present, however. The mere presence of bacteria in the bile is not sufficient to cause lithiasis because they may be retained for some time, as Blachstein and Welch observed some years ago, without inducing any inflammation of the mucosa.

Welch also demonstrated the presence of the colon bacillus in the interior of gall stones and Lartigan found this organism in 25 per cent. of the stones which he examined.

In 1893 Chiari called attention to the frequency with which enteric fever was associated with gall stones and found the typhoid bacillus in the gall bladder of nineteen out of twenty-two cases of typhoid fever coming to autopsy and in these positive cases the walls of the gall bladder in thirteen showed evidence of inflammation.

The bacilli are usually found in clumps, a gigantic Widal reaction seeming to have taken place, as Richardson remarks.

Cushing, in 1898, found that ten out of thirty-one cases of cholelithiasis in Halstead's clinic, gave a history of enteric fever. He also reported a case operated upon for cholelithiasis in which the typhoid bacillus was found in the gall bladder, the patient having none of the clinical symptoms of the disease.

The number of stones found may vary from one to several thousand and in size may be barely perceptible, or as large as a lemon. In a case reported by Richter the stone weighed somewhat over 100 grams. When the stones are numerous they are polygonal in shape with smooth facets at their junction with each other and are about the same size. At times five or six well formed concretions may be found, quite round and with a mulberry appearance. In consistency they may be soft and putty-like, crumbling under the touch, or firm and when fractured presenting a crystalline appearance. In some instances they are as hard as the lithic acid vesical stone. The usual color is a dirty brown. The greater portion of the stone, about 75 per cent., consists of cholesterolin, but bile salts, bile pigment, mucus and epithelium may enter into the composition. The outer layer of the stone is usually harder and contains more of the lime salts. Sometimes a pure cholesterolin stone is found.

When gall stones have formed in the gall bladder they do not constitute a serious disease, unless symptoms of cholecystitis supervene.

It has often been shown at postmortem that stones existed without ever having given the individual any discomfort during life. Kehr states that not more than one in twenty of those having gall stones suffer any inconvenience from their presence. But tissue which has once been the subject of inflammation, however mild, and in which there is the additional trauma of the presence of gall stones, will furnish a fertile soil for the culture of bacteria.

A slight infection of the gall bladder may subside quickly leaving the means for gall stone formation behind it and should a re-infection take place with the colon bacillus, for instance, an acute cholecystitis with gall stones results. The mucous membrane becomes softened and congested, there is a free secretion of mucus and purulent fluid may form. The inflammatory process may force a stone into the cystic duct and obstruct that channel, and if the cholecystitis subsides and the stone remains blocking the duct, a hydrops of the gall bladder may follow from accumulation of mucus.

In other cases there is no passage of stones into the cystic duct but the infection, if virulent, progresses to purulent or gangrenous cholecystitis with a tense, distended gall bladder filled with pus and bile and with extensive ulceration of the mucous membrane. In milder infections the inflammatory symptoms may subside into a period of latency, the bile once more flowing in and out of the gall bladder and the stones resting quietly, giving no symptoms. But frequently during attacks of cholecystitis the inflammatory process extends through the coats of the gall bladder and gives rise to adhesions to liver, colon, stomach, duodenum or omentum which cause vague pains and gastro-intestinal disturbances after the attack has passed.

Recurring attacks of inflammation in the gall bladder will gradually thicken its walls and lead to shrinkage of the organ with perhaps strictures or contortions. The mucosa shows signs of chronic degeneration, with round celled infiltration giving place to connective tissue proliferation and hypertrophy of the muscular coat.

During an attack of acute cholecystitis the stone may be driven through the cystic and into the common duct, where it may lodge or pass on down the duct and, if small enough, escape into the duodenum, or what is more likely to happen become impacted in the common duct near its orifice. If the stone lodges it is apt to enlarge from the continual precipitation of cholesterin and may completely obstruct the

duct. In this case the common duct and the hepatic ducts dilate and jaundice is a rapid result with the other symptoms of cholemia. The walls of the duct at the point of impaction may ulcerate and the stone escape into a neighboring viscus which has become adherent. In some instances only partial obstruction takes place and the bile escapes, to some extent, around the stone. In this case chronic obstruction of the duct follows.

If the infection ascends the hepatic ducts, a cholangitis results with infection of the liver and in severe cases, abscess formation. Stones are rarely found in the hepatic duct, but when present cause grave symptoms. As a rule, the smaller ducts escape infection from their better drainage but sometimes, after acute cholangitis, a chronic condition persists with secretion of a thick ropy mucus which may cause symptoms exactly similar to the passage of a gall stone.

In discussing the symptoms of cholelithiasis we must repeat that stones may exist in the gall bladder without giving rise to any symptoms whatsoever so long as the ducts are free. In other cases, vague gastric symptoms with epigastric discomfort and a feeling of depression or of slightly defined pains over the right side of the abdomen increased by "straightening up" may be the only symptoms. Jaundice is absent and the liver is not enlarged. There may be some tenderness over the gall bladder. Such a history may be obtained when stones are present in the gall bladder with clear ducts and without much disease of the bladder walls. If infection is present, it is latent.

If an attack of acute cholecystitis supervenes pain becomes at once a prominent symptom. It may be paroxysmal in character, but usually lasts for hours or days and beginning over the gall bladder is referred to the right breast or right shoulder. Nausea and vomiting precede or rapidly follow the colic. The right rectus is rigid and constipation is the rule. Jaundice is not observed unless cholangitis or stone in the common duct or hepatic duct or a markedly catarrhal condition at the duodenal orifice is present. Palpation will reveal the gall bladder as a tense, rounded and very tender tumor beneath the rib margin, moving with respiration. Local peritonitis is a certain result from the extension of the inflammation through the walls of the gall bladder and may complicate the diagnosis by causing marked and general rigidity.

Occasionally a tongue-like enlargement of the right lobe of the liver may be observed. This is Riedel's lobe. Should this acute attack

subside the gall bladder will be left thickened and surrounded by adhesions with symptoms depending upon the nature and position of these adhesions. In the gall bladder so affected future attacks of cholecystitis become more and more difficult to diagnose, unless a clear previous history can be obtained. The gall bladder does not then present the rounded tumor moving with respiration nor is the colic so severe, but with the history of the previous attacks, with probably a dilated stomach and the nature and position of the colicky pain a diagnosis may be made.

In a case of acute cholecystitis with gall stones which becomes suppurative the condition is more serious. With empyema we have the usual history of gall stone attacks followed by a tender, rounded swelling making its appearance and with the pain becoming more continuous; the right rectus becomes rigid; there are few constitutional symptoms early, but later the usual manifestations of sepsis appear, rigors or chills with fever. There is no jaundice unless there is an associated catarrh of the bile ducts. Empyema always causes a pericholecystitis which will give the symptoms of local peritonitis. Perforation with abscess formation is not uncommon and the pus usually travels along the course of the suspensory ligament to the umbilicus. It may point down alongside the colon toward the right iliac fossa or form a mass over the gall bladder and ulcerate through the abdominal wall. Sometimes ulceration takes place into the duodenum, colon, stomach, portal vein and vena cava, etc.

Hydrops of the gall bladder due to chronic obstruction of the cystic duct presents but few symptoms. Palpation detects a rounded, smooth tumor which is quite painless as a rule, and when depressed into the abdomen will return immediately. It has been mistaken for a right-sided ovarian cyst or a floating kidney. Jaundice is not present.

When acute inflammation of the gall bladder forces a stone into the cystic duct the gall bladder enlarges and is quite painful and the symptoms of acute cholecystitis are augmented by the pain caused by the passage of the stone through the inflamed and spiral cystic duct. It is in acute obstruction of the common duct, however, that the classical symptoms of gall stone colic are seen. The attack sets in suddenly as a rule with intense, agonizing pain in the right hypochondriac region and radiating to the shoulder, though it may radiate downward to the sacral region. Some patients complain of pain across the back.

Persistent vomiting is associated, often fever and a sensation of chilliness. In severe attacks the patient completely collapses with sweating and a cold clammy skin. With the passage of the stone into the duodenum, there is an immediate cessation of symptoms.

Should the stone become impacted in the duct jaundice rapidly follows with the usual yellow skin and dark, bile-stained urine. The feces are the color of pipe clay. Palpation seldom reveals anything, as the cystic duct may be clear, but a large stone in the cystic duct compressing the hepatic may give the symptoms of obstructive jaundice plus those of obstruction of the cystic duct. The liver is not enlarged. There are no septic symptoms unless an ascending infection of the hepatic ducts takes place. The obstruction is freed, either by the onward passage of the stone, by rupture of the duct and fistula formation, or it may become chronic.

In chronic obstruction the duct dilating behind the stone will allow the bile to escape around the obstruction and the jaundice fades, but the stone may pass downward a trifle and again the symptoms of acute obstruction appear. This chronic obstruction persists for some time with intermittent attacks of pain, fever and jaundice and unless surgical intervention takes place, the sufferer becomes a chronic invalid.

When a calculus becomes impacted at the duodenal orifice there may not only be the symptoms of obstructive jaundice but serious lesions of the pancreas may result. Opie has collected thirty-eight cases in which pancreatic lesions, fat necrosis and cholelithiasis coexisted.

The more remote sequelæ of gall stones in the common duct are: (1) Ulceration, hemorrhage, perforation or stricture of the duct itself. (2) Local or general peritonitis following rupture. (3) Adhesions to neighboring organs and the formation of fistula through which the stone discharges. (4) Intestinal obstruction due to; (a) the size of the stone. (b) volvulus of the small intestine, (c) adhesions from the gall bladder region obstructing the lumen of the bowel. (5) Abscess or cirrhosis of the liver. (6) Pancreatitis. (7) Carcinoma of gall bladder or ducts.

Fistulæ have been observed between the biliary passages and the stomach, duodenum, jejunum, ileum, colon, urinary organs, thorax, abdominal walls and retroperitoneal tissues. In most instances the occurrence of fistula is impossible to diagnose. The passage of a very

large stone in the stools would establish a diagnosis of fistula into the alimentary canal. Cases have been reported in which gall stones have been vomited and these were undoubtedly due to biliary-gastric fistulæ.

In making a differential diagnosis between gall stone disease and other affections we are often confronted with a difficult and perplexing problem. A surgeon rarely sees the patient during the first attacks, when the gall bladder is free from adhesions and when secondary gastric or intestinal symptoms are absent.

Appendicitis is frequently confounded with gall stones accompanied by cholecystitis. With the appendix in the right iliac fossa the diagnosis can be made by the location of the pain and tenderness, the rigidity of the abdominal wall of the lower right quadrant of the belly, the sudden onset, the absence of chills, as a rule, and the more marked relief obtained by flexion of the right thigh. But in those cases in which the appendix extends upward toward the gall bladder and with its tip nearly in contact with it the diagnosis may be impossible to make.

Ulcers of the stomach or duodenum may give symptoms simulating gall stone disease and more especially when adhesions have formed from the gall bladder to the pylorus or duodenum. The pain of ulcer is more nearly related to the ingestion of food and is more constant in the epigastric region or radiating to the back and not to the shoulder. The association of chlorosis, increased hydrochloric acid secretion and hematemesis with ulcer should be remembered.

A movable kidney on the right side with its paroxysmal attacks of pain and rounded movable tumor has been mistaken for an enlarged and calculous gall bladder. This is especially the case when a sufficient degree of hepatoptosis is also present with obstruction to the flow of bile in the common or hepatic ducts and a resulting jaundice.

Steele in a study of one hundred reported cases of floating liver has found that colic-like pains, often accompanied by jaundice and simulating gall stone attacks, were present in nearly 40 per cent. of the cases.

In the kidney affection the tumor may be repositied and will remain so with the patient in the recumbent position. The kidney movements are not pendulous in character.

An enlarged gall bladder has a fixed point from which it moves in

the arc of a circle and even in the recumbent position it will remain immediately behind the abdominal wall. The gall bladder, moreover, is more tender and harder to the touch than the displaced kidney.

In lead colic, the history of the patient, absolute constipation, the blue line on the gums and the colicky pains centering about the umbilicus should decide the diagnosis.

The gastric crises of locomotor ataxia have been confused with gall stone disease. The loss of the kneejerk and the ocular palsy are early symptoms in the former disease.

In acute pancreatitis the pain is more sudden in its onset, beginning in the epigastrium and later becoming general. There is marked loss of weight and strength followed by collapse and early symptoms of peritonitis about the pancreas. Chronic pancreatitis often accompanies gall stones in the common duct and its diagnosis is not of such great moment because a surgical operation is required for its relief. The pain is less severe and is usually localized to a point one inch above and one inch to the right of the umbilicus.

Intestinal obstruction from mechanical causes may be simulated by a paralysis of the intestine dependent upon a local peritonitis from inflammation of the gall bladder region. The diagnosis may not be made until the abdomen is opened. A careful history of previous similar attacks, with or without jaundice, the absence of fecal vomiting or visible peristaltic movements and the more constant localization of pain to the right side should help in forming a diagnosis.

In malignant disease with obstruction of the common duct the jaundice is intense and continuous, pain is absent, as a rule, and the gall bladder is usually distended. As the disease progresses the well-marked cachexia is evident, ascites may develop and a tumor can usually be palpated. The two conditions often coexist and in the early stage the diagnosis of malignancy is very difficult to make.

The treatment of gall stones resolves itself into palliative or medical and radical or surgical.

The medical treatment has been gradually losing ground of late years. This is due to the want of success in finding a drug which will dissolve gall stones and from the brilliant results of surgeons who operate upon a large number of gall stone subjects. The Durande mixture of ether and turpentine and various saline cholagogues, such as sodium salicylate, sulphate, benzoate, phosphate, bicarbonate, succinate and chloride, potassium sulphate and ammonium chloride have

all been advocated by various authorities. Olive oil is frequently given in nauseating quantities, yet there is not the slightest evidence that the oil can reach the gall bladder. Mayo Robson states that after an extensive use of oil he has never seen much good result from its employment. This is quite in accord with the writer's experience.

More modern medical views place the efficacy of oil in their hands to an increased flow from the mucous membrane. Thomson administers it in small quantities, never over two ounces at a single dose and given for ten consecutive nights, then intermitted for a week and again continued.

Granting that gall stones could be dissolved, the results of inflammation, such as stricture, adhesions, perforations, fistulæ, etc., are not cured. If we possessed an agent that would be capable of contracting the gall bladder to such a degree as to expel its contents, the risk would be greater than the good accomplished from obstruction of the cystic duct by a stone too large to pass through it. After supposed cures of gall stone colic it is not by any means certain that the gall bladder is free from stones and that a fistulous communication with a part of the intestinal tract has not been established.

Much stress is laid upon the wonderful effects of the Carlsbad waters. It is undoubtedly true that many sufferers are relieved by this course of treatment, but as Kehr puts it, "the principal material at Carlsbad is the gall bladder lithiasis of the prosperous class and not the chronic obstruction of the common bile duct." In those of sluggish habits and torpid constitutions the regular mode of living, the soothing effect of the warm medicated waters and the laxative action of the springs are all conducive to a powerful and beneficial stimulation of the tissues. The efficacy of the Carlsbad treatment lies in the subsidence of the inflammatory process, not in the expulsion or the dissolving of the calculi. That the hot Sprudel salts will relieve gall stone pain, there is no doubt; further, the stimulation of the liver and the portal system in general, aids very materially toward bringing about this temporary cure.

In cases of mild gall bladder infection the symptoms are relieved and a period of latency established by prompt medical treatment; but the attacks recurring again and again result in complications which cannot be relieved by medical means.

Cholecystitis occurring during enteric fever has been frequently observed by the writer, but fortunately has never required operative

interference. Unless the condition becomes advanced, operation is not advised because of the systemic disease from which the patient is suffering and the chance of inducing perforation by the trauma of operation.

Acute obstruction of the common duct should never be operated upon during the acute stage. The stone, having left the gall bladder is moving through the common duct and may reach the duodenum. When the disease drags on, however, with fever and increased pulse rate, then the time has arrived when to defer operation is no longer warrantable. During the acute stage the pain may be alleviated with small doses of morphine, absolute rest enjoined and hot applications applied to the hypochondriac region. The stools should be searched for the presence of stones. After the subsidence of the attack, intestinal antiseptics may be administered and the bowels kept freely moving. Digestion should be regulated, regular exercise and warm bathing ordered and the case carefully watched.

Should symptoms of obstruction again return after apparent relief, indicating a fixed position of the stone, operation should be immediately advised. The temptation naturally arises to try the same treatment which was successful in the first instance, but this either leads to chronic morphinism or to some complication of the gall ducts, leaving the patient in a wretched condition when he finally comes to the operating table.

It should be remembered that the mortality of choledochotomy is as high as that of acute appendicitis with pus outside of the appendix and that the mortality of operation when stones are still in the gall bladder is nearly as low as the removal of an appendix in the early stages of inflammation before the suppurative process has become extra-appendicular.

When a suppurative cholangitis occurs recovery is very unusual. Pancreatitis from obstruction by a gall stone is a serious and often a fatal condition. These mortalities should be borne in mind when hesitating over the treatment of gall stones.

Suppurative cholecystitis with or without a stone in the cystic duct requires cholecystotomy and drainage. Hydrops of the gall bladder usually calls for cholecystotomy and drainage, though if there be considerable disease of the walls of the bladder, such as marked thickening or calcification, a cholecystectomy may be best. In cholangitis and chronic pancreatitis drainage holds out much promise for recovery.

In the former instance the hepatic ducts are drained directly by incising the common duct and carrying the drainage tube into the hepatic duct. In chronic obstruction of the cystic, common or hepatic ducts, choledochotomy must be performed and the stone removed. Crushing the stone *in situ* if it cannot be done with the fingers I regard as attended by no little danger. Dislodging the stone and carrying it into either the gall bladder or the duodenum, depending of course whether it occupies the cystic or common duct, I have never been able to do except in a few instances.

In operating upon gall stone subjects calcium chloride should be administered for a few days previous to operation, giving ten or twenty grains three times a day. It seems to lower the time required for the blood to coagulate and thus lessens the risk of postoperative bleeding. The presence of the bile products in the blood has some action, as yet imperfectly understood, which greatly retards coagulation. The writer has lost cases from severe capillary oozing following an otherwise apparently successful operation.

The placing of a sand pillow beneath the back will so arch the liver forward that when the abdomen is opened the liver may easily be drawn out of the abdomen far enough to make a better exposure of the biliary passages. Adhesions should be carefully separated and unnecessary handling of the liver, gall bladder or ducts avoided.

Cholecystotomy. The gall bladder is exposed by an incision through the right rectus muscle and, excepting in highly infectious cases, is generally freed from adhesions, which when met with usually involve the abdominal wall, liver, omentum, duodenum and pylorus. The gall bladder is isolated by gauze pads and aspirated of its contents. The puncture is then enlarged and the gall bladder examined for stones; if present they may be removed with forceps or a scoop. A small piece of iodoform gauze is introduced into the gall bladder and the opening temporarily closed with an hemostatic forceps. The gall bladder is then brought into the wound if possible. A piece of gauze is passed around the gall bladder in such a manner as to allow the lower end of the gauze to protrude from the lower end of the wound and the gall bladder is sutured to the aponeurotic layer of the abdominal wall. Before tying the gall bladder sutures the gauze pads are removed, but not the gauze around the gall bladder. The sutures are tied, the wound in the abdominal wall above and below the gall bladder closed, the hemostatic forceps removed, the piece of

iodoform gauze taken out of the gall bladder and a solid rubber drainage tube carried into that organ. This drains into a receptacle at the side of the patient.

When acute empyema exists it is safer in most cases to merely suture and drain the gall bladder, not searching for calculi until the danger of infecting the ducts has disappeared. When it is impossible to bring the gall bladder into a position favorable for its suture to the peritoneum, it must be protected by gauze packing after introducing the drainage tube. Acute infectious gall bladders should be palpated as little as is consistent with good work, and in these cases the common duct should not as a rule be probed for the presence of a stone.

The so called "ideal" cholecystotomy in which the opening in the gall bladder is sutured after removing the stone or stones is an unsafe procedure unless the case be free from infection and the suturing very carefully performed, and, bearing in mind the fact mentioned early in this paper that calculi in most instances are due to bacterial infection, these cases are necessarily few. Homans has reported a case in which gall stones formed around silk sutures twenty months after recovery from cholecystotomy.

Cholecystectomy or excision of the gall bladder. Mayo Robson gives the following indications for this operation: (1) In bullet wound or other wound of the gall bladder when suture is impracticable; (2) in phlegmonous cholecystitis; (3) in gangrene of the gall bladder; (4) in multiple or in perforating ulcers; (5) in chronic cholecystitis from gall stones, when the gall bladder is shrunk and too small to safely drain, and when the common duct is free from obstruction; (6) in mucous fistula due to stricture of the cystic duct; (7) in hydrops of the gall bladder due to stricture of the cystic duct, also in certain cases in which the gall bladder is very much dilated; (8) in certain cases of empyema, in which the walls of the gall bladder are very seriously damaged; (9) in carcinoma of the gall bladder.

With these indications I can agree in most points, but think that acute phlegmonous cholecystitis and gangrene of the gall bladder are better opened and drained. Carcinoma of the gall bladder can rarely be diagnosed until after extensive infiltration of the lymphatics has taken place, in which case operation would only hasten death.

In chronic cholecystitis with gall stones, there is so often, such

marked adhesion of the structures around the gall bladder that its removal is very difficult. An attempt to dissect it loose from the liver is followed by considerable oozing and necessitates gauze drainage. The writer is usually satisfied with breaking up the adhesions about the pylorus, duodenum and colon, and covering the raw surfaces with "Cargile." The gall bladder is then opened, the calculi removed and a rubber drainage tube protected by a gauze strip introduced into the gall bladder. Stones firmly impacted in the cystic duct necessitate cysticotomy. Adhesions following the removal of the gall bladder frequently leave the patient in little better condition than before operation. The Mayo operation, enucleating the mucous membrane is applicable in only a comparatively few cases.

Choledochotomy is performed by incising the duct over the stone, removing it and searching with the finger and probe to ascertain that the ducts are clear, this is particularly important. The main, as well as the right and left hepatic ducts are to be explored. The wound in the common duct may be closed with Lembert sutures if the integrity of the duct will permit and always drained with a gauze strip. If the position of the duct renders suture impossible, or if its coats are infiltrated and friable, a rubber drainage tube should be introduced well into the hepatic duct and carefully surrounded by gauze packing. In certain cases of choledochotomy it is wise to drain the gall bladder as well.

When calculi are situated close to the duodenum, in the ampulla of Vater the duodenum must be opened through its anterior wall and the duct laid open from within the duodenum. If no intestinal contents have escaped, a Lembert suture of the duodenum is sufficient, without drainage.

When the common duct, immediately to the proximal side of the ampulla of Vater, is the site of a stone which cannot be crushed between the fingers or dislodged the duct may be exposed by reflecting the posterior parietal peritoneum to the outer side of the descending duodenum.

Choledochenterostomy is rarely performed. The writer has never had a case requiring this operation.

Cholecystenterostomy is an operation which should be confined to those cases of obstruction of the common duct due to stricture or to a malignant growth and in some cases of external gall bladder fistula. This operation was formerly performed by the writer in chronic pancreatitis but has latterly been abandoned for cholecystotomy.

Postoperative vomiting is frequent in gall bladder surgery and is often difficult to control. Lavage and the administration of all nourishment by the rectum are the best agents for its control.

Should capillary oozing follow operations on markedly jaundiced patients all treatment usually fails and the patient becomes exsanguinated and death results. Calcium chloride may be administered by the rectum, twenty grains every four hours in connection with full doses of opium.

The recurrence of pain after a successful operation is not due to the recurrence of stones, in the majority of instances, but to the presence of adhesions; the latter being amenable to operative interference with less risk than that attending the primary operative procedure. The early establishment of peristalsis may prevent the formation of adhesions.

Biliary fistulæ following cholecystostomy persist for a few months as a rule but ultimately close. Continued persistence of the fistula is due to some obstruction of the common duct.

Mucous fistulæ may also result from the same operation and are due to an obstruction of the cystic duct. Sometimes a mucous fistula follows a cholecystectomy and is due to continued secretion from "islands" of mucous membrane not destroyed by the operation.

In conclusion the writer urges that the best possible time for the patient to be referred to the surgeon is when the stones are still in the gall bladder; that the severity of the ailment increases and that the case is less promising both from the internist's as well as from the surgeon's standpoint after the stone has passed into the common duct. There is practically no mortality from the removal of stones from the gall bladder in the quiescent state, while the operation of removing a stone from the common duct is serious and difficult. Such operators as Kehr and Robson have a mortality of from 10 to 20 per cent. in their common duct operations.

The writer further asks his medical colleagues to witness gall bladder surgery and in this wise to familiarize themselves with the living pathology of the disease, its extent and its ravages; when he feels sure that, like in appendicitis, they will be convinced that it is the part of wisdom to advise operation in their gall stone patients at a much earlier date than has been their custom in the past.

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DISCUSSION.

DR. WILLIAM L. RODMAN fully coincided with Dr. Deaver in his position that gall stones are largely if not practically always due to microbic invasion. There can be little doubt that the colon bacillus and the typhoid bacillus often find their way into the gall bladder and cause cholelithiasis. Why it is that gall stones are more frequent in the female no one has explained. It is also true that they are practically unknown in the first decade of life, rare in the second and infrequent under thirty. They are almost never found in the colored race. This he attributed to the better teeth and therefore better digestion of the colored race who also ate less highly seasoned food, etc. As to differential diagnosis he believes it true that gall stones may be mistaken for appendicitis, for gastric ulcer and for dislocated kidney. Impacted stones in the common duct are more apt to be confounded with malignant disease than other conditions. The jaundice in both though persistent is apt to be remittent in gall stones. The steady persistence of the jaundice in malignant disease is due to a tumor which is increasing in size. The intermittent character of the jaundice in impacted stone he considers a most important point in diagnosis. Some of the bile escapes around the calculus when the spasm relaxes and in this way reaches the bowel. There is a ball and valve action in such cases. Though a surgeon Dr. Rodman believes there is a medical side in the treatment of gall stones. The influence of the Carlsbad water he believes is perhaps the very best that can be had, and the regular living at Carlsbad he believes very conducive to the betterment of patients with cholelithiasis. Phosphate of soda gives good results, but he has seen but little good from olive oil. Concerning the surgical side of the question he emphasizes Dr. Deaver's remarks upon the value of early operation, and agrees with him that an operation left until there is impaction in the common duct is like a belated operation for appendicitis in its high mortality. The comparison is a happy one and should be emphasized. In many instances he believes that a stone can be milked back into the gall bladder or forward into the duodenum, and refers to the fact that Mayo Robson has removed many such stones. Attempts to crush a stone between forceps he believes dangerous practice and one that should not be carried out. He agrees with Dr. Deaver that if a sand bag is placed at the back that the gall bladder is brought forward and that even an impacted stone in the common duct can be treated with greatest facility. In cholecystenterostomy for malignant stricture the mortality in Dr. Rodman's opinion is almost prohibitive. In cases in which the stricture is benign the operation is of great advantage. When the stone is as low down

as the ampulla of Vater Dr. Rodman makes an incision in the anterior wall of the duodenum which is slit up until the ampulla is reached and then the bowel carefully sutured. It seems to him wise to make a posterior opening for drainage in case there should be soiling of the peritoneum. He is inclined to drain in this way as he would do in gunshot wounds of the abdomen.

DR. JAMES TYSON said that it has been his good fortune to follow the lesson which Dr. Deaver has attempted to inculcate and to witness a number of gall stone operations. He has by these opportunities been more and more convinced of the comparative futility of medical treatment and the rapidly curative effect of operations. Although he believes in the utility of the Carlsbad treatment, he thinks few surgeons realize how many stones are removed at Carlsbad by operation. The difficulty in diagnosis has impressed him very much as it has Dr. Martin, as has also the difficulty in distinguishing between malignant disease and cholelithiasis. It is surprising, he said, how many cases of malignant disease of the liver will live and remain continuously jaundiced, and it has occurred to him that such cases unaccompanied by attacks of pain are apt to be cases of malignant disease of the liver. The diagnosis between calculus and catarrhal jaundice is also often not very easy. In confirmation of his experience in more than one instance Dr. Tyson referred to a case showing the difficulty in diagnosis.

DR. JOHN H. MUSSEY does not lay much stress upon age as a diagnostic factor of cholelithiasis; as he has seen some of the most severe cases between the 18th and the 21st years. The frequency of the disease in males, he believes, is greater than the text-books state. The history of pain situated only in the right hypochondriac region he does not think can be relied upon as characteristic of gall stones. He has seen a number of cases in which the pain was high up in the epigastrium. When the situation of pain is unusual there will be greater difficulty in operation. A carefully worked out previous medical history is very valuable in making the diagnosis. The greatest difficulties in the differential diagnosis he believes arise in differentiating between mild and grave forms of cholecystitis and between pancreatic disease and gall stones. Mild forms of cholecystitis are usually associated with some infection, either previous to or at the time of the local symptoms which aid in recognition of the catarrhal process. Suppurative cholecystitis is probably more easily recognized, at least it is readily differentiated from mild forms. It may be difficult to distinguish it from one or 2 other affections of the gall bladder or in the region of the gall bladder, as cholelithiasis, on the one hand, and gumma, on the other. Leukocytosis is suggestive of suppuration. The previous history of gall stones and of obstruction from gall stones is suggestive when local symptoms with high temperature are present. As distinguished from suppuration in the pancreas he lays great stress upon gall bladder infection if chills and fever are present. The distinction of pancreatic colic and that of gall stones he regards as difficult, and yet if it is borne in mind that the pancreas lies to the left of the median line, and the gall bladder to the right the difficulty will be lessened. Other distinguishing features are that pancreatitis and pancreatic hemorrhage are associated with interference with respiration of the left side, whereas the right side is rarely interfered with

unless there is a tumor of the gall bladder and peritonitis; also, that pancreatic disease is associated with displacement of the heart. In pancreatic disease there is more liable to be thrombosis of the portal vein and the occurrence of a moderate amount of ascites than in hepatic disease other than that actually obstructing the portal vein. Regarding the differentiation between cholecystitis and multiple small abscesses of the liver he has seen cases which he believed to be cholecystitis but which operation showed that no infection of the gall bladder was present. Autopsy revealed multiple small abscess of the liver. The liver had increased in size which is against the diagnosis of gall bladder disease. The course of the disease and etiological factors of multiple abscess, enables one to make a differential diagnosis.

DR. J. M. ANDERS referred to the fact that Marion Sims was one of the first to state that cholelithiasis is a surgical disease. It cannot be doubted that the greatest advances in treatment and to a lesser degree in the symptomatology have been made by the surgeons. He recalled several instances in which typhoid fever preceded, and in one instance by 5 years, the occurrence of cholelithiasis. It is a remarkable fact that the typhoid bacillus may be isolated in pure culture as long as 7 years after the occurrence of typhoid fever. He is not wholly in accord with the view that microorganisms are the sole cause of cholelithiasis. Were this so the disease, he believes, would be more common in young subjects and the great majority would not occur in the female. It must be remembered that pregnancy exercises an unquestioned influence upon the occurrence of cholelithiasis. Anything that causes thickening of the bile tends to favor the formation of gall stones, and here the medical measures so fully and clearly detailed by Dr. Stewart are most useful, as preventive rather than curative. Upon the family physician rests the responsibility of making the diagnosis and instituting the initial treatment. In those cases in which jaundice is absent one cannot be quite certain of diagnosis as a rule, no matter how clear may be the previous history. It seems to him important from a medical point of view to distinguish between calculous cholecystitis and noncalculous cholecystitis. The latter is still regarded as being largely a medical disease; while cholelithiasis is more distinctly surgical. Although as Dr. Martin states, cholelithiasis sometimes develops suddenly there is, in the majority of cases, pain or a feeling of tension to the right of the spine on a level with the 10th or 11th rib for some time before the more typical pain is manifested. Gall stone crepitus can often be elicited in cases in which the gall bladder is well filled with stones and the cystic duct is occluded, with relaxation of the abdominal muscles, and aids in deciding in favor of cholelithiasis as against noncalculous cholecystitis. With improved methods Dr. Anders believes gall stones can be detected by the X-rays. At the present day C. Beck, of New Jersey, claims to be able to show their presence. After the first attack of cholelithiasis treatment early becomes surgical. When the diagnosis of cholelithiasis is definite Dr. Anders believes that early operation promises the best results because dangerous complications and sequelæ will be avoided. In cases in which nonfaceted calculi are passed, operation should be deferred, since, in his experience, no further trouble arises in these instances as a rule.

DR. MAX J. STERN stated that the belief expressed by some of the speakers that cholelithiasis should be regarded as a surgical disease was in contradistinction to the view held by Kehr and himself. They believed that up to a certain time the disease in the vast majority of cases is distinctly a medical one and amenable to medical treatment. It is, generally speaking, not now considering hydrops and empyema, only after repeated attacks and when medical treatment has failed to give relief that the surgeon should be called in, excepting in those cases in which a stone is lodged in the common duct, and of too great a diameter to be expelled. Dr. Stern believes the condition may occur at any age. He had recently seen a case in a child of 8 and one in a child of 12 and still another in a boy of 14. One of his colleagues had seen a case in a child of 6. Jaundice he believes occurs in a very, very, small percentage of cases. In regard to etiology, while it may be true as has been claimed that gall stones are of bacterial origin, Dr. Stern was not prepared to either confirm or refute the theory, but is positive that no one theory has as yet been advanced which will include the method of production in all cases. Dr. Stern, however, firmly believed that all attacks of gall stone colic were due to the invasion of a bacterium, that is, there is another factor necessary, gall stones being present, to produce the phenomena characteristic of cholelithiasis and that is an acute inflammation dependent on bacterial invasion. Hydrops of the gall bladder at times does quite well without operative interference. The treatment at Carlsbad he believes has absolutely no effect upon the stones, and that anything accomplished in Carlsbad can be done in Philadelphia or elsewhere under the same treatment, the patient living under the same condition and devoting an equal amount of energy to his cure. One of the most formidable types of jaundice met with is due to a chronic interstitial pancreatitis. This is due to enlargement of the head of the pancreas and consequent pressure upon the common duct. The gastric symptoms he believes are reflex due to contiguous inflammation, adhesions, and in part may be ascribed to the involved gall bladder and not to an inherent disease of the stomach. The reason for this belief is based upon the fact that immediately after a radical operation there is a disappearance of all gastric symptoms. The best treatment medically he believes to be absolute rest, the application of heat in the shape of the hot water bag or coil, in the neighborhood of the gall bladder, salines, lavage of the stomach, restricted diet and morphine. This is the common practice in Kehr's clinic in cases not operated upon. The jaundice he does not believe is entirely due to occlusion but that it is an infective disease probably microbic in origin, not due entirely to the suppression of bile, but due to a disease of the individual liver cell which may and probably has its cause in some microbic invasion. The common remedy in preparing a patient for operation, against the dangers of hemorrhage, which in all probability is exaggerated, is calcium chloride in larger doses than suggested by Dr. Stewart. Gelatine has been frequently tried, but owing to the danger of tetanus has been abandoned in Kehr's clinic and in the speaker's practice. The cases which Dr. Stern has seen die of hemorrhage, have not been due to bleeding from the wound, but death followed from extravasated blood from the mucous membrane of the stomach in enormous quantities. Indeed

all the cases which he has seen die of hemorrhage have been in those who died suddenly prior to contemplated operative interference.

DR. STEWART, in closing, said that he thinks that too much stress is laid upon the matter of jaundice in these cases; that there are many more cases of cholecystitis than of stone in the common duct and in the former condition there can be no jaundice. Regarding the situation of pain as a diagnostic symptom, he said that frequently the pain is referred to the epigastrium; when, upon close questioning of the patient as to the most sensitive point, it would be found to be in the region of the gall bladder. The question of the cholecystitis being calculous or not has nothing to do with operation; obstruction of the cystic duct is an indication for operation. He said that he did not know that Kehr was so tardy in operating. Hydrops of the gall bladder will disappear if the obstruction is not due to stone in the cystic duct; but, as it is commonly due to this, operation is usually indicated. A case in point was cited.

DR. DEEVER, in closing, agreed with Dr. Rodman that cholecystenterostomy has a field in the presence of benign strictures and in certain persistent fistulæ of the gall bladder. In carcinoma, however, he thinks little of its value. With Dr. Anders he believes that the differential diagnosis in calculous and noncalculous cholecystitis is very difficult. He always uses the X-rays in his cases, though he is not clear as to their value. In the large gall stone cases a shadow is always shown, which is not so in the noncalculous cases. This plus the other characteristic symptoms and a previous attack aids in diagnosis. He thinks it more difficult to exclude inflammation of surrounding organs than to make a diagnosis of gall bladder disease. His experience is that gauze drainage used judiciously is not a factor in causing adhesions. He considers the blood count of diagnostic value in the active inflammatory cases.

Electrothermic Hemostasis in Hysterectomy for Carcinoma.

BY ANDREW J. DOWNES, M. D.

[Read October 22.]

Late diagnosis and imperfect operative removal are the two great stumbling blocks in the treatment of carcinoma of the uterus. The former to a great extent can be laid at the door of the earlier medical advisers and the latter to the fact that the usual operations give little from which to choose. It has often occurred to me that the medical attendants of these unfortunate women had some excuse for their tardiness in the very unfavorable results of usual operative measures as evidenced by published statistics. An operation offering a better primary mortality rate with less liability to recurrence should prove

a great stimulus to the medical adviser to sift out those suffering with the disease in its incipency. The word "usual" in connection with operation in this paper has reference to all ligature operations. The method to be advocated here is unusual; it is novel and yet not new. It is unusual in that few as yet have performed it; it is novel because it takes the surgeon away from routine practice and requires him to become familiar with an unaccustomed instrumentarium. It is not new because its essential features were published as early as five years ago. During the last three years in a number of monographs I have called attention to the practicability of electrothermic hemostasis especially in hysterectomy, yet to-day throughout the world surgeons are inexplicably slow in carefully looking into this subject, and therefore, in using a very practical aid to accurate surgery. It is difficult to convince surgeons that the ligature can be dispensed with and it is all the more so if in doing it they are required to use unusual instruments and agents. Surgeons did not hesitate to use the various materials or methods of sterilization which succeeded each other in perfecting the ligature. They early established the limitations of torsion and lately they have proved the unreliability and the great danger of angiotripsy. It would, however, be difficult to name a dozen surgeons who have had a fair experience with electrothermic hemostasis. Until within a little over a year the imperfections of the instruments and the electrical apparatus required for use with them could be offered as an excuse, but this no longer obtains. It remains for surgeons to go deeply into this subject and by practical experience, not by theory, disprove the claims of its advocates. For one I can truthfully say that I have about discarded the ligature in abdominal surgery and I am finding it more and more difficult to meet a case in which I cannot dispense with it and use electrothermic hemostasis and do quicker, cleaner and more accurate work.

In the treatment of carcinoma of the uterus hemostasis has always been most important, for such cases do not well stand loss of blood. Another important point in this disease is that we should hemostase in the tissues as far removed from the uterus as possible, with the view of going beyond the limits of malignancy. All malignant cell life at the line of section should be killed, the lymphatic vessels leading from this area should be sealed and rendered nonabsorptive. Electrothermic hemostasis alone fulfills these requirements. So unsuccessful even in early cases have been the ultimate results from the ligature

and clamp hysterectomies that the various cauterizing operations on the cervix have received great attention. As showing to what extent this has gone Dr. Fredericks, of Buffalo, at the last meeting of the American Medical Association, at Saratoga, in a very strong paper advocated cautery amputation of the cervix as all that should be done for these cases. The recently deceased Dr. John Byrne did more than any other to develop and popularize cautery amputation of the cervix in cervical carcinoma and published statistics apparently corroborating his views. Whatever arguments have favored the cervical amputation as against a wide hysterectomy apply only to ligature operations and do not avail against electrothermic hysterectomies, in which cautery amputation of the cervix is usually one step. Certainly, if the malignant tissue in the cervix is so restricted that the cautery in amputating goes beyond its limits the procedure is justifiable. But how can we be certain of this? A microscopical section of a malignant cervix showing the diseased cells extending very little beyond the mucous membrane and entirely within the cervical tissue does not disprove that the disease may be at the paracervical junction or that it has extended beyond the cervix into the fundus. We have not yet discovered the final microscopical evidence of carcinoma. This should mean that we cannot, within the limits of safety, go too widely into the uterine surroundings, and that cervical amputation, even with a cautery knife, is logically inferior to a hysterectomy in which the broad ligaments and paracervical tissues have been hemostased by pressure and heat. It cannot be denied that the results of cauterizing operations of the cervix compare favorably with the usual hysterectomy because of the lessened primary mortality rate and a claimed equal freedom from recurrence. There is very much reason to expect that the comparison will not hold against electrothermic hysterectomy, which owing to its bloodlessness and the small amount of shock caused by it should give an exceedingly small primary mortality and which logically should, in a much larger proportion, avert recurrence. The outfit for electrothermic hysterectomy consists of three angiotribes alike except in the size of the blades, which vary in width only. The blades are each two and three-eighths inches long and the widths one-quarter, three-eighths and one-half inches. The handles are self-releasing and the two larger sizes have levers to increase the pressure. The heating arrangement is such that the acting blade can be brought to the proper temperature in from ten to twenty seconds according to

the size of the blade. When the operating room has the current installed there is required a transformer for the alternating current and a motor, in addition, for the continuous current. The cable is rubber covered; has lava tips; can be sterilized and placed with our instruments. My cautery knife is specially required. The platinum forming its blade requires the same amperage as will properly heat the blades of my electrothermic angiotribes and can be used, therefore, as an index of the proper current. This is a practical way of dispensing with a meter in circuit. Another way of doing without a meter

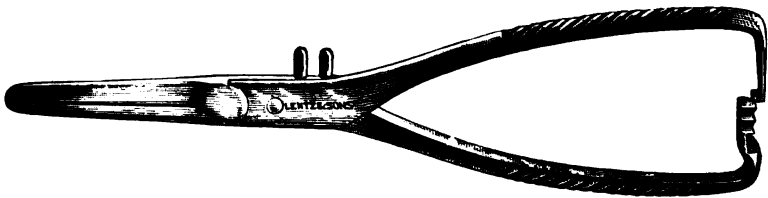


FIG. 1.

Electrothermic angiotribe with blades one-fourth inch wide. The blades open by pressing the handles beyond the last holding catch.

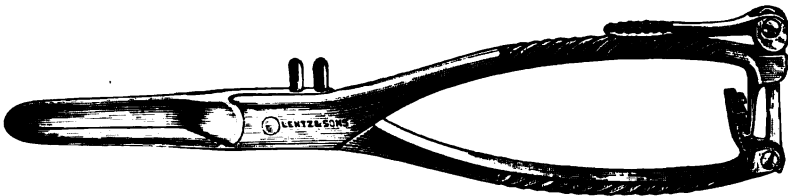


FIG. 2.

Electrothermic angiotribe with blades three-eighths or one-half inch wide. The lever maintains maximum pressure. The blades open on release of the lever.

is to gradually turn to a point on the rheostat that will give a current that will cause water placed on the blades to boil in approximately ten, fifteen and twenty seconds respectively for the small, medium and large blade. This strength current will give a bright cherry red to the cautery knife. The instruments are stamped sixty amperes and with a meter in circuit scientific accuracy is possible. In the beginning I strongly advocated a meter but during the last six months practical dependence on this method of hemostasis alone enables me to say that the meter is safely dispensed with. Where there is no current a storage battery of seventy-five ampere hours' capacity when fully charged will give sufficient current for at least three major operations.

By this method I have performed five hysterectomies for carcinoma. The first two were reported fully in *American Medicine*, May 24, 1902. They were both vaginal hysterectomies in which the steps of the operation in each case were first high amputation of the cervix with my cautery knife and second the removal of the uterine body by bringing the fundus out of the postvaginal peritoneal incision and applying the blades of my electrothermic angiotribe to the broad ligaments to the outside of the ovaries and making section on the uterine side. The operations were almost bloodless, the broad ligaments were thoroughly compressed and cooked and the paracervical dissection made wide and the fresh surfaces carefully seared. The first operation was performed November 5, 1901, the second December 11, 1901. Both were adenocarcinomata of the cervix. The patients improved remarkably and as yet show no sign of recurrence.

CASE III.—Mrs. B. S., aged 41 years, white, had given birth to 5 children and had a number of miscarriages. A year and a half ago was curretted after a miscarriage. During the last 8 months has been bleeding continuously, at times quite freely. For the last few months has had pains in the pelvis. Patient is well-nourished and has lost little flesh. Uterus is slightly enlarged but in normal position. Mucous membrane of the vagina is of normal color; cervix is slightly thickened and elongated. The posterior lip for fully one-half its surface is absent, being replaced by an excavated ulcerated area, which merges into the posterior vaginal wall. There is apparently slight infiltration in the paracervical region. Operation April 5, 1902. The cervix was pulled down by volcellum forceps and a wide, circular incision made with my cautery knife in the vault of the vagina so as to skirt the involvement at the postcervical junction. The cervix was dissected high up and widely; the paracervical walls being cauterized as the dissection proceeded and finally the cervix amputated at the internal os.

The cavity of the remainder of the uterus was cauterized, the vagina cleansed and packed with gauze. The abdomen was now opened in the Trendelenburg position. The nonadherent uterus was drawn up by tenaculum forceps and my heavy electrothermic angiotribe with blades one and one-half inches wide applied to the broad ligament from without the ovary to about the center of the body of the uterus. The current was allowed to act thirty seconds and the blades allowed to remain thirty seconds longer, when they were removed and section made bloodlessly through the uterine side of the agglutinated dessicated track of the blades. The same procedure was carried out on the left side and the same bloodless section made. The blades were again applied to the right side to include the uterine artery and section made on the uterine side. The blades were then applied to the base of the left broad ligament to include the left uterine artery and section made on the inner side. The uterovesical and postcervical peritoneum was then incised and

dissection continued until the vaginal vault was reached. My narrow blades were then used to encircle the portion of the uterus still held at the vaginal vault, section being made to the uterine side of the blades after each application, and the uterus thus delivered. The entire procedure was practically bloodless. The reflections of peritoneum were united by a double row of continuous suture, and the abdomen closed. Gauze was removed from the vagina and a fresh piece inserted. Convalescence was uneventful and the patient is in good health. Pathological diagnosis: squamous celled carcinoma.

CASE IV.—Mrs. C., aged 37 years; widow; has had one child. Always well until last August (1902), when a slight leukorrhea was noticed. This gave the patient no alarm though a progressive weakness soon accompanied it. About 10 months after the beginning of her discharge she experienced pain in the rectum and great pain on defecation. For this she consulted a physician who attributed it to piles, but treatment was unavailing. The leukorrhea had by this time become blood-tinged. Operation, September 9, 1902. Examination showed that the growth began at junction of postuterine lip and vaginal wall. The disease had excavated a space $1\frac{1}{4}$ inches long by $\frac{1}{2}$ inch wide on the posterior vaginal wall and extended quite a distance behind and above the cervix. The sides of the diseased area in the vagina were necrotic and thick. I began the operation by resecting the vagina from the vulva orifice to above the cervix although it was not possible to get below the disease on the ulcerated posterior surface of bowel which I allowed to remain temporarily. The vaginal enucleation was continued to above the cervix, which was amputated. The abdomen was next opened with the patient in the Trendelenburg position. The uterus which was found retroverted and adherent was freed and elevated by tenaculum forceps and the electrothermic angiotribe with blades $\frac{3}{8}$ inch wide applied to the broad ligaments, 2 applications to each side. In this operation temporary hemostatic clamps were applied along the uterine side of the broad ligaments and section made along the inner side of the electrothermic blades after the cooking process was finished. This is probably the surest way of using these instruments in hysterectomy as it gives a wider dessicated track and avoids undue manipulation. The uterus was now freed except the paracervical tissue holding the cervix to the vault of the vagina. The narrow blades of my small size angiotribe encircled in sections this cuff and release of the uterus was obtained by progressive section along the inner side of the blades. A bloodless hysterectomy was the result. The already severed vesical and rectal reflections of peritoneum were now united by a double row of continuous catgut sutures, and the abdominal incision closed in tiers. The patient was again placed in the dorsal position and as thoroughly as possible a portion of the upper wall of the rectum an inch and a half long and $\frac{3}{4}$ of an inch wide removed and the rent sutured together by catgut. It would have been very easy at this time to have resected quite a large portion of the rectum, for while working within the abdominal incision I had freed the lower portion of the sigmoid and pushed it below the subsequently doubly united peritoneum hence working in the enucleated vaginal cavity there would have been plenty of room to resect. At the time it seemed that I was removing all diseased tissue in taking away the portion of the

rectal wall. The patient did exceedingly well and was relieved of the severe pelvic pain she had before operation. I realized immediately after the operation that it was a mistake to use catgut sutures to close the rectal rent. On the 5th day feces appeared in the vagina from the reopened rent in the rectum. On the 12th day I attempted to close this large rectovaginal fistula and did reduce it very much but at the same time discovered that the rectum was more involved than was apparent at the first operation and that the extent of the involvement of the right lower pelvic wall precluded any chance of relief. This patient had been considered inoperable at another clinic. I was aware that it was a far advanced case, yet considered it right to give her the chance of a wide electrothermic hysterectomy. The extent of the rectal and extrarectal involvement was greater than anticipated. The case is reported to show the surgical possibilities of electrothermic hysterectomy. Not a ligature was used in this case. Pathological diagnosis: Epithelial carcinoma far advanced.

CASE V.—Mrs C., aged 56 years, married for 30 years, menopause 4 years ago. Twenty years ago had uterine treatment and from the description must have had intracervical and uterine medication and instrumentation. She first noticed a discharge in June of the present year which was first watery and soon yellowish. First saw blood stain in July and had the first hemorrhage of moment on September 4, the day before entering the hospital. Has had severe pain low in the pelvis a year and during this year lost 40 pounds in weight. Examination through a narrow contracted vagina showed a congested, slightly eroded, but quite patulous os. By bimanual palpation only was a diagnosis possible. Within the os, the finger could detect a necrotic condition and the cervix was quite enlarged and fixed. Operation September 9, 1902. It was impossible to work on vaginal side except to sterilize and pack with gauze. The abdomen was opened with the patient in the Trendelenburg position. The fundus was found retroverted and with the tubes and ovaries bound by adhesions. The uterus was freed and four applications of my $\frac{3}{8}$ in. blade angiotribe made to the broad ligaments, section being made between the electrothermic blades and temporary hemostatic forceps on the uterine side of the broad ligament. The vesical reflection and the recto-uterine peritoneum was carefully severed and the thick, bulky cervix dissected out using the points of my narrow blade angiotribe alone for hemostasis. The limits of the cervix were widely skirted without entering its necrosed center until the vaginal tube had been freed for $1\frac{1}{2}$ inches below the os. Traction was made on the uterus thus lengthening the vaginal tube so that the cautery knife could be made to sever it. The peritoneal reflexions were united by a double row of continuous catgut sutures and the abdomen closed in tiers. The specimen on removal was an intact mass consisting of the ovaries, tubes, fundus, cervix (larger than the fundus) and the connecting $1\frac{1}{2}$ inches of vagina. The patient suffered no shock and did exceedingly well. Urine appeared from the vagina on the second day and was caused by the cautery touching the base of the bladder in making section across the vagina. The patient has left the hospital looking very much better than when she entered, but has a slight vesicovaginal fistula. Pathological diagnosis: Epithelial carcinoma.

In these five hysterectomies for carcinoma not an abdominal ligature was used and a wider dissection made than is usual. At the same time the hemostased tissue was seared or cooked. The operations were incomparably less bloody than ligature work. The patient reacted rapidly and gave no evidence of shock. Unfortunately with one exception cure cannot be expected; in this case, the first, the disease was so limited and extended so little beyond the endocervical mucous membrane that the outcome can be awaited hopefully.

Besides my own cases I have assisted Dr. Chas. P. Noble and he has used my instruments in five hysterectomies for carcinoma. I have used the instruments for Dr. Barton C. Hirst at the Howard Hospital once and for Dr. Howard A. Kelly, at Johns Hopkins Hospital twice. Dr. Noble who used the instruments himself applied catgut ligatures to the broad ligaments after cooking and compressing them. Low in the pelvis and in the work on the cervix from the vaginal side he depended on the points of the narrow blade angiotribe. His broad ligament sections were bloodless and I feel certain he will soon be convinced that the ligature is superfluous behind a track of broad ligament cooked under great pressure. The special requirements in hysterectomy for carcinoma were carried out by his procedure. My hysterectomy for Dr. Hirst was performed without a ligature as was the first for Dr. Kelly in which the uterus and entire vagina were removed. In Dr. Kelly's second case the same day a ligature was applied to the right uterine artery and this not because we could not use the electrothermic angiotribe. Dr. Noble's, Dr. Hirst's and Dr. Kelly's hysterectomies were performed within a month making thirteen hysterectomies for carcinoma by the electrothermic method in the last year.

In this connection the following case is interesting. Mrs. F., at that time 33 years old, I saw in consultation in October, 1899, and on the 14th of the same month performed a vaginal hysterectomy for carcinoma. While not having seen her I had heard she was well and 2 years after the operation was 20 pounds heavier. Six weeks ago there was a sign of blood from the vagina. She was referred to me October 18, and to-day (22d) I attempted the useless task of cleaning out the infiltrated thick recurrent mass in the vault of the vagina involving even the base of the bladder. It appears to me that if at the first operation in place of using clamps I had made a careful and wide dissection from below and around the cervix searing the outer paracervical wall, even cooking under compression the vaginal ends of the broad ligaments, and had then opened the abdomen and cooked the broad ligaments close to the pelvic wall and had finally cooked and compressed widely at the abdomino-vaginal junction to meet the dissection from below, the patient might not have

had a recurrence. It would seem that after the operation 3 years ago there must have been left in the vaginal cuff or in the base of the broad ligament some element of malignancy or some implantation during operation must have occurred. The method advocated in this paper would have left the raw surfaces of the paracervix seared, it would have left the bases of the broad ligaments compressed and cooked so that presenting malignant cells would have been killed.

Besides, the seared surfaces with closed lymphatics would have proved a poor ground for implantation. As to the type of operation possible by this method it can be said that any hysterectomy that can be performed by the ligature can more easily be done by electrothermic hemostasis. The following are some of the variations in technique in electrothermic hysterectomy. The half-inch-wide blade may be applied to the broad ligaments and section made along the uterine side of the agglutinated track. This method dispenses with temporary clamps to the uterine side of the broad ligaments but greater care is necessary not to make too much traction on the hemostased tracks. A better procedure is to apply hysterectomy clamps to the uterine side of the broad ligaments and make section along the inner side of the thermic blades on the removal of which the tracks should be manipulated as little as possible. In some cases it will be possible to include both the ovarian and the uterine arteries in one grasp of the blades. In most cases the best plan is to apply the blades from outside the ovaries to the side of the uterus as low down as where we sever the vesico-uterine peritoneum, the application to the opposite side preceding the freeing of the bladder. With the bladder sufficiently freed the blades are applied from the terminus of the already made tracks to include the uterine arteries going as far away from the cervix as possible using care to avoid the ureters. Section on the inner side of the blades should be made, preferably before removing them, thus again avoiding undue manipulation deep in the pelvis. The dissection can now be continued in the paracervical tissues using the points of the narrow blades to bleeding vessels and continuing around the vaginal tube some distance below the cervix, finally severing the vagina with a cautery knife or as is possible going around the vaginal cuff with the points of the narrow-bladed forceps. Where the operation started on the vaginal side the dissection from above will meet that made below.

In using these instruments the field should be as dry as possible, the acting face of the blades should be smeared with sterile oil and

the surrounding tissues protected, and the blades cleaned of any charred blood on them before reapplying. For protection in the pelvis I have been using gauze; but lately I have devised a metal shield that nearly surrounds the blades and remains cool. The shield is so constructed that it comes in contact only by points which transmit very little heat.

In conclusion, this method is not presented in a spirit of enthusiasm as a certain means of curing carcinoma of the uterus but one showing definite points of improvement over the usual procedures. As already stated, I use electrothermic hemostasis to the exclusion of other methods. Being so practical and being logically indicated in hysterectomy for carcinoma it should appeal to the careful consideration of

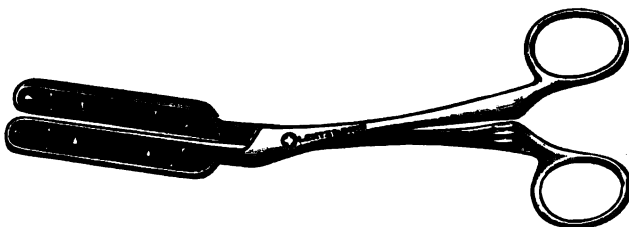


FIG. 3.

View of shield for surrounding the blades of the angiotribe deep in the pelvis. The contact of the shield surface is by points only. The shield remains cool.

surgeons. Any logical operation progressing on lines already proven to be valuable should be given practical tests in carcinoma if we are to increase the percentage of nonrecurrence.

DISCUSSION.

DR. BARTON COOKE HIRST said he had been profoundly discouraged by the ultimate results of the surgical treatment of carcinoma of the cervix uteri and that it was disheartening to recall how few of the women were now alive in whom the primary results of the operation had been good. Two propositions have been made to improve the results of operation for carcinoma of the cervix; one is to remove the lymphatic glands of the pelvis and abdomen, and the other to dissect out the lateral parametrium of the cervix. Neither, however, have been satisfactory. The first method was founded on lack of information, the lymphatic glands usually not being involved in carcinoma of the cervix. Removal of the parametrium has not proved successful, because there is just as much danger of implantation metastasis as in the old method. Dr. Hirst had about concluded that Byrnes' method was better than hysterectomy when he heard of the method of Dr. Downes. He had been so much impressed with its value in his case, in which Dr. Downes had kindly assisted him, that he

will employ it in all cases of carcinoma of the uterus. It combines all the advantages of hysterectomy with those of Byrnes' operation. It seems to him that the future will show better results by Dr. Downes' method and instruments than have been hitherto secured.

DR. CHARLES P. NOBLE said that his experience in the recurrence of carcinoma has not been quite as unfavorable as that usually published. About 20% of the patients have remained well for five years. That, however, includes a good many cases of carcinoma of the body of the uterus. It is his opinion that with the older method almost all cases of carcinoma of the body of the uterus can be cured. In carcinoma of the cervix he always uses the cautery knife because he is impressed with the work of Dr. Byrnes, and burns the paracervical tissues as he did. This Dr. Noble thought might be the reason he has secured a somewhat larger percentage of cures than have those operators who use the ligature and scissors. Dr. Noble has used Downes' instruments in 3 cases with great satisfaction. The only objection to the use of these instruments is the possibility of occasionally burning a hole in the ureter, since the ureter is not more than $\frac{1}{8}$ inch from the cervix and the instruments are at least that wide. Even though this accident should occur, if recurrence of the disease can be diminished by sealing up the lymphatics the patient can well afford to have a fistula which can be repaired by a later operation.

Dr. J. M. FISHER referred to a case of amputation of the breast in which he had assisted Dr. Downes, and in which the ordinary hemostatic clamp had been used with the Downes electrotherm. This new feature introduced by Dr. Downes changes preconceived ideas of the proper control of bleeding. In the use of both silk and catgut it is always necessary to leave a button of tissue exposed to subsequent carcinoma implantation; but in the use of the electrohemostatic forceps no projecting masses are left beyond the point of contact, the tissues are thoroughly cooked, and the heat may even reach the carcinoma cells at some distance. The use of the angiotribe with the electric current passing through one of the blades, pressing out all the watery elements of the tissues is a feature of much value. Another important point is the fact that the parts seared in the use of the instrument again become revitalized. Also, there is no sloughing of structure and there is little tendency to adhesions. Other points of value are destruction of the carcinoma cells at the place of contact with the forceps, the freedom from pain after operation, the bloodlessness of the operation and the possibility of complete sterilization.

DR. JOHN B. SHOBER said that he feels that we owe Dr. Downes a debt of appreciation for again bringing this method of hemostasis before the profession, but that it must not be forgotten that Dr. Skene, of Brooklyn, many years ago demonstrated the value of such instruments, which, like these, could be sterilized and with which he had done a number of bloodless operations in the pelvis without the use of a ligature. At a meeting of the American Gynecological Society held in Boston in May, 1898, he demonstrated his instruments and showed how easily and rapidly a piece of meat could be cooked into a "thin ribbon." Dr. Skene's instruments were not as perfect as these of Dr. Downes and could not be sterilized with such perfection. Still, Dr. Shober feels that it should be strongly brought out in this meeting that the method is by no means a new one.

DR. DOWNES, in closing, stated that in reference to the point, made by Dr. Noble, about injuring the ureters by this method of operating that there is much less danger because the entire blade of the instrument is always in view; whereas, we are not always sure where the invisible point of a ligature carrier may go. With bougies in the ureters during operation electrothermic hemostasis is more accurate than ligature work. Referring to Dr. Shober's remarks Dr. Downes stated that in a number of articles he had given Dr. Skene credit for originating electrohemostatic instruments. Dr. Skene had worked with Dr. Keith, who was the first to use pressure and heat to control hemorrhage, using the actual cautery at the sides of pressure forceps. Dr. Skene, who often used this cruder method of Keith, on seeing an electric flatiron, conceived the idea of including the heating medium within the blades of the pressure forceps. The originator of heat and pressure to control hemorrhage is Keith. The introduction of the first electric instrument to replace Keith's crude process is due to Skene. Skene's instruments were first productions and full of imperfections. The evolution that my ideas have given electrothermic hemostatic instruments was absolutely necessary to render this method of hemostasis practical.

Report of a Case of Chronic Splenic Anemia.

BY JAMES ELY TALLEY, M. D.

[Read November 26.]

Mrs. M. A., aged 34 years, married, was born in the West Indies of an English father and an American mother. Her father died at 62 of carcinoma of the stomach and liver. The mother is living at 73. The rest of the family history is negative. The patient lived in the West Indies until 6 years old, and during that time had dysentery and malaria "with ague-cake." Since coming to the United States she has always lived in or around Philadelphia and never had any serious illness. She was pale and slender as a girl, but her menses appeared at the regular time and were always normal. She had frequent attacks of epistaxis, which were worse before her marriage, 6 years ago, than they ever were before or since. Syphilis and alcohol are excluded. She has two children, 5 and 2½ years old.

When first seen, over 5 years ago, during her first pregnancy, she was extremely anemic looking, but she was sure that she was always pale and of a muddy complexion and yet had good health. At that time the spleen was moderately enlarged, but the old history of malaria, the existence of mitral regurgitant disease and continued soundness of the urine led to passing over the condition with the giving of iron. She passed through the first labor without any difficulties and during the second pregnancy her condition was the same, and the labor easy. In June, 1901, when 7 months pregnant, she was caught in a heavy rain and thoroughly soaked. Two days later she was taken ill with fever—100° to 101°—and vomiting, purging and pain and

tenderness in the right iliac fossa. The attack was characteristic of appendicitis, but the acute symptoms rapidly subsided. However, distress and some tenderness persisted in the right lower quadrant of the abdomen and disappeared only after the sudden birth of a premature child, two weeks later. The child was living when born but succumbed during the first day. There was no fever following the labor nor any discharge suggestive of new infection, though the patient appeared very sick. There was a moderate dilation of the heart at this time, the pulse was rapid and irregular, there was some venous pulsation, some dyspnea and the murmurs now heard were hemic in type. It was at the beginning of this attack that the very unusual increase in the enlargement of the spleen was noticed; it appeared to fill the whole left side of the abdomen; its lower border extended fully to the anterior superior spine of ilium; its upper border was some inches above the costal arch; its anterior border was to the right of the mammary line; and its posterior border extended to a line drawn perpendicularly through the inferior angle of the scapula. On palpation the spleen was smooth, firm and not tender. As she lay on her back the bulging forward of the abdominal wall by its bulk was quite noticeable, though the patient herself had not observed the very evident tumor until her attention was called to it. The liver was not appreciably enlarged, there was no jaundice, no edema, no glandular enlargement and the urine was normal. The blood, taken some hours preceding the precipitate labor, showed red bloodcorpuscles, 1,960,000; hemoglobin, 44%; white bloodcorpuscles, 12,200; and there were no plasmodia. The recovery of strength was slow, the lochia normal but prolonged. Six weeks after delivery the uterus was still somewhat enlarged, deflected to the right and apparently anchored by adhesions, which were probably due to extension of inflammation from around the appendix as there was no previous cause known. If the pain and tenderness had not been so definitely located in the right iliac region away from the spleen one might have thought of perisplenitis, a rather common condition in splenic anemia. After taking peptonated iron and arsenic for more than a year with short intermissions, the patient gradually improved and the spleen gradually shrunk.

The table giving the results of the blood examinations at intervals during this time shows almost unbroken improvement. Fresh specimens showed no poikilocytes, no megaloblasts and no nucleated red bloodcorpuscles.

Date.	Erythrocytes.	Hemoglobin.	Leukocytes.
6-13-01.	1,960,000	44%	12,200
6-26-01.	1,990,000	46%	9,200
7-10-01.	2,704,000	56%	4,600
2-20-02.	2,880,000	72%	7,200
7-15-02.	1,936,000	70%	11,600
9-16-02.	3,800,000	74%	3,800

The differential count was made from blood taken July 15, 1902. Of 845 leukocytes counted, there were polymorphonuclears, 589, 69.7%; small mononuclears, 148, 17.5%; large mononuclears, 67, 8.0%; transitionals, 25, 3.0%; eosinophiles, 16, 1.8%.

The red cells did not take the stain well. There were apparently a few poikilocytes, but no nucleated erythrocytes.

On examination September 14, 1902, the patient, though thin, said she felt as well as ever, but she was still anemic looking and the skin was darker in hue than normal. There was no glandular enlargement; the liver was normal; the pulse was 80 and regular; the muscular sounds of the heart were good; but there was a well-marked mitral regurgitant murmur. The spleen was decreased in size, its lower border lying four finger-breadths above the anterior superior spine of the ilium and it was narrower and flatter than a year before. There were still occasional attacks of epistaxis. The menses were regular and there were no nervous symptoms.

The enlarged spleen, anemia without leukocytosis and hemorrhages in the form of repeated epistaxes are the most important symptom-complex in that somewhat uncertain condition called splenic anemia. In the latter condition the spleen is said to be idiopathically enlarged while in this case there is a remote cause for the enlargement, the malaria with ague-cake of twenty-three years before. According to Osler¹ the West Indies and Central America furnish us the worst cases of malarial cachexia, a condition characterized by anemia and great enlargement of the spleen with or without frank attacks of malaria preceding it. The usual history of such cases, if the condition has not lasted long and the patient removes to a healthy climate and is treated, is the disappearance of the anemia and the gradual reduction in the size of the spleen. "In other instances," Osler says, "the anemia gradually disappears, but the 'ague-cake' remains in spite of all treatment. After persisting for some years, great reduction in this organ may occur, but I have never seen the enormous spleen of chronic malarial cachexia, reaching for example to the pubes, restored to its normal size."

Again, Machiafava and Bignami² say that persons in whom the malarial infection has disappeared may have for a long time enlarged spleens and livers without any interference with the blood-making functions. In this particular case more or less anemia appears to have existed during all these years, though on that point proofs are wanting, also the proofs of the condition of the spleen from the time she had malaria twenty-three years ago up to five and one-half years ago when first seen. Moreover, in considering the anemia and epistaxis in this case, the impaired heart must be borne in mind.

The marked increase of the splenic enlargement in June, 1901, and its subsequent decrease probably depend upon more than one fac-

tor; namely, infection, venous congestion, crowding forward of the spleen by the enlarged uterus and a possible exacerbation of the splenic anemia itself. The acute symptoms of appendicitis were so short-lived that it could have had little bearing on the spleen, yet there must have been a low grade of inflammatory process going on in the right iliac region for two weeks as the pain and tenderness persisted until after the premature labor and afterward there were adhesions pulling the uterus to that side; yet the leukocyte count on the very day of delivery was only 12,200. Venous congestion, according to Rolleston,³ especially where the liver was not also enlarged would not be a decided element in causing enlargement of the spleen. The crowding forward of the enlarged spleen by the pregnant uterus in a woman with relaxed abdominal walls certainly served to bring the spleen into prominence if the fact of pregnancy itself had no other bearing in the matter.

The possible exacerbation of the primary condition itself is hypothetical. At least no case of splenic anemia with such a sudden increase in the size of the spleen followed by a diminution has been found recorded. However, it seems proper to record this case as one of splenic anemia, the malaria being so remote as not to be considered a primary etiological factor in the development of the splenic condition, and the condition in June, 1901, being due to the intercurrent pregnancy and appendicitis. The gradual improvement of the patient during the past year does not invalidate the conclusion inasmuch as the enlarged spleen still exists and a blood count of 3,800,000 red blood-corpuscles and 74 per cent. of hemoglobin is not higher than in many cases.

A review of the literature of splenic anemia is superfluous at this time, as the article of Sippy⁴ and the more recent one of Wentworth⁵ cover the ground. Especially to be noted in this connection is the masterly paper on the subject by Osler in *The American Journal of the Medical Sciences* for this present month.

REFERENCES.—1. Allbutt's System of Medicine, Vol. II, p. 786. 2. Twentieth Century Practice, Vol. XIX, p. 480. 3. Allbutt's System of Medicine, Vol. IV, p. 530. 4. Am. J. M. Sci., 1899, II. 5. Boston M. & S. J., October, 1901.

DISCUSSION.

DR. A. A. ESHNER thought that in the present state of knowledge the term splenic anemia is a convenient designation for a complex of symptoms essentially comprised in the description of the case reported by Dr. Talley.

Namely, enlargement of the spleen, with a moderate degree of anemia, a considerable reduction in the hemoglobin percentage, without increase, sometimes with a reduction, in the number of leukocytes, hemorrhages from mucous membranes, and at a late stage with enlargement of the spleen, jaundice and ascites. Nothing definite is known as to the nature or the etiology of the disorder, although the current tendency is to consider it as due either to an infection or an intoxication, giving rise to enlargement of the spleen in conjunction with the secondary anemia or to both conditions jointly. Whether the splenic condition is directly related as an etiological factor in the development of the anemia is also involved in doubt. It seems to Dr. Eshner that both occurrences may be the result of a common cause, although, on the other hand, it must be borne in mind that the enlargement of the spleen with the histological changes that take place in it may be one factor in a vicious circle intensifying an associated anemia and in turn being increased thereby. In Dr. Talley's case, as in at least 2 of the cases recently reported by Osler, there was a history of previous malaria. That the spleen apparently plays some part in either the development or the aggravation of the symptoms, would, in part at least, be indicated, by the results of the removal of the spleen as a therapeutic procedure. There are cases on record in which improvement has followed such surgical interference.

The Meaning and Significance of Leukocytosis.

BY ROBERT N. WILLSON, M. D.

[Read November 26.]

The following discussion was begun in the mind of the writer a number of years ago, when cases began to come under his personal observation that failed to fulfil the requirements of the accepted definition of the term. Certain cases, and indeed the great majority, showed under well-known conditions a decided increase in the number of all the forms of leukocytes in the blood.

For a long time it had been believed that the polymorphonuclear forms were, in such cases, always in excess; and in 1897 Cabot, accordingly, formulated a definition of the term leukocytosis that has until recently served as the standard of teaching, throughout the United States at least. His definition of leukocytosis was as follows:—"An increase in the number of leukocytes in the peripheral blood over the number normal in the individual case, this increase never involving a diminution in the polymorphonuclear varieties, but generally a marked absolute and relative gain over the number previously present."

The experience of the writer has gradually led him, not only to question the accuracy of the above definition, but to call attention to certain forms of leukocytosis that have been noted by himself and other observers, but of which little has been written or said up to the present time. Actual cases seem to show that in at least two important respects Cabot's definition of 1897 is in error, viz:

(1) Leukocytosis should not necessarily imply an increase in the total number of leukocytes, even in the presence of an active inflammatory influence. The total number of leukocytes may be normal or below normal in the individual, and a significant leukocytosis still be present, if there is a relatively high percentage of the polymorphonuclear cells. Such an increase implies that the same processes are at work as are suggested by a numerical increase in the total number of cells, and is of even greater import.

(2) Notwithstanding the presence of inflammatory causes in the body exerting influences that are sufficient to cause an absolute increase in the number of leukocytes, the percentage of polymorphonuclear forms may not only not be increased, but even diminished in the individual case, owing to other and more potent specific influences.

In discussing these forms of leukocytosis the terms relative and absolute will be used because they are now generally understood, and also because they have been employed in a similar sense in previous papers by the writer. By relative leukocytosis will be understood all forms of leukocytosis in which the polymorphonuclear forms are in marked excess of the normal percentage (70-75). By absolute leukocytosis we will imply an increase in the total number of leukocytes in the individual case, irrespective of the percentages of the various forms.

RELATIVE LEUKOCYTOSIS.

This subject has been briefly referred to by the writer in several papers published during the two past years. Its importance has grown with each new case in which it has been noted, until the conclusion seems warranted that *not only do many cases occur in which a decided increase in the number of polymorphonuclear forms is apparent in the absence of an increase in the total number of leukocytes, but that such a decided increase in the number of polymorphonuclear forms under these circumstances suggests either the presence of pus or some other active inflammatory condition in addition to a grave loss of power in the natural resisting forces of the body.*

Many clinicians have noted cases in which an absolute leukocytosis has been present and gradually fallen as the energy of the body gave way. Some have even gone so far as to make an occasional observation upon such an occurrence. In the same chapter as has already been quoted Cabot says, "In some cases in which the absolute number of leukocytes is not increased, we see a relative increase in the adult cells, pointing to the fact that influences are at work similar to those which produce an absolute increase."

Many others, before and since the foregoing was written, and among them Thayer, at Johns Hopkins Hospital, have cited occasional cases in which the same theory has been demonstrated as true. Nearly every one has regarded these cases, however, as rare exceptions to the ordinary, and the necessity for being on the watch for a relative leukocytosis as a needless precaution. No one except the writer, up to the time of a recent and unfortunately personal discussion of the value of blood examinations in general, seems to have found the routine examination of the relative percentages of the leukocytes in ordinary conditions either of particular interest or worthy of their attention. At that time he endeavored to show that the blood was not thoroughly examined in any case until a differential count of the leukocytes had been made; and several cases were cited to demonstrate the value of the discovery of a relative leukocytosis of marked proportions. Since the publication of these articles it has been a source of pleasure to learn that in many different directions a renewed interest has been excited in the percentage of the various forms of leukocytes, though with considerable skepticism and doubt as to the value of such study. It would seem, therefore, not out of place at this time to again call the attention of clinicians as well as of all blood students, to the value of relative leukocytosis as a clinical sign, and to study its actual significance.

No one will deny that in most cases of inflammation the polymorphonuclear leukocytes increase out of proportion to the other forms, at the same time with and in the presence of an increase of the absolute number of leukocytes. In such cases, as for example the ordinary instances of intestinal inflammations, tonsillar infections, appendicitis, pleural and abdominal effusions, pneumonia, etc., the process is expected and regular and the preponderance of the multinuclear forms becomes the more marked with the intensity of the infection and the increased efforts at resistance on the part of the tissues

of the body. In such cases, we may say, as we have had occasion to remark before, both the absolute and relative leukocytosis to be of any value must be weighed in close connection with the clinical symptoms, and must never be depended upon to form a diagnosis nor allowed alone to indicate operative or any other vital measures. The writer has, however, yet to see a case in which either an absolute leukocytosis has been present, followed by a fall to or below the normal number of leukocytes, *with a persistence of the high percentage of polymorphonuclear forms*; or in which there has been from the beginning a complete absence of absolute leukocytosis, and yet a decided increase in the percentage (85-100) of polymorphonuclear forms,—to repeat, he has yet to see such a case in which there has not been found either a purulent collection, or some grave inflammatory process that threatens the life of the patient.

On the other hand, a considerable number of cases has been previously cited in which the truth of this assertion has been evidenced. The following, including several already mentioned, demonstrate both acute and chronic conditions in which the principle held true.

CASE I was that of a child, aged 8 years. This case presented a moderate absolute and a very high relative leukocytosis. The condition, as noted at the operation would indicate that the resistance of the body was at a low ebb, and the absolute leukocytosis, therefore, not high. Forty hours previous to the blood examination she was well. Since then she had grown fretful with pain in the abdomen. Had passed a few large round worms the day before, and vomited one. Her appearance was decidedly septic. Distinct pain and tenderness on pressure centered around the appendiceal region. Rigidity of the abdomen. Blood examination (1-29-'02) gave: H., 74%; r.b.c., 5,824,000; leukocytes, 17,200; polymorphonuclear cells, 96%. No other pathological changes in the blood. The operation showed a gangrenous appendix and a large quantity of foul pus in the abdominal cavity.

CASE II.—A typhoid patient of 6 weeks standing. This case illustrates the presence of a marked polymorphonuclear increase in the complete absence of absolute leukocytosis. The patient's general condition improved, and yet the fever chart showed that all was not as it should be; the high percentage of polymorphonuclear cells persisted until the physical signs and the operation demonstrated the presence of pus. In this case the typhoid influence was unfavorable to a leukocytosis, and yet while it was not overcome sufficiently to allow of the production of an absolute leukocytosis it was counteracted sufficiently to admit of a polymorphonuclear rise to 92%. The temperature had several times reached normal, and for some days had been bounding up and down in a septic fashion. There had been no chill,

and no symptom over the body for some time since to account for the temperature. The blood examination made for Dr. Morris J. Lewis (1-9-'02) gave H., 95%; r.b.c., 4,960,000; leukocytes, 7,800; no differential count made. No malarial organisms. No pigmented leukocytes. On (1-24-'02) the blood showed H., 70-75%; r.b.c., 3,832,000; leukocytes, 4,800; polymorphonuclear cells, 92%. No other pathological change in the blood picture. Condition continued without change, and on 1-30-'02 the examination showed H., 78%; r.b.c., 4,962,000; leukocytes, 9,200; polymorphonuclear cells, 92%. On this day a slight bulging was made out in the apex of the vaginal wall. No abdominal tenderness or mass felt then or at any time previous. Operation showed a large ovarian abscess, from the pus of which a pure culture of typhoid bacillus was obtained. The blood examination made the day after operation (2-6-'02) gave H., 60%; r.b.c., 4,320,000; and leukocytes, 7,900; polymorphonuclear cells, 72%. This last examination was made by Dr. Longcope at the Pennsylvania Hospital, and of course after the pus had been evacuated. The case was reported in full by Dr. Lewis at a later date. (*Am. J. M. Sci.*, October, 1902.)

CASE III demonstrated the influence of even a chronic suppurative condition upon the percentage of polymorphonuclear cells, and this in the absence of an absolute leukocytosis. The patient was a Swedish girl, with a walnut-sized abscess of the axillary glands. Otherwise well. Blood examination before incision of glands (2-10-'02) gave H., 94%; r.b.c., 5,220,000; leukocytes, 7,600; polymorphonuclear cells, 94%. No other pathological blood changes. Blood examination on day following, H., 92%; r.b.c., 5,232,000; leukocytes, 8,200; polymorphonuclear cells, 78%.

CASE IV examined for Dr. Packard during convalescence from lobar pneumonia of several weeks standing. Temperature irregular. Pneumonia still unresolved at the base of the lung. Symptoms indicate a pleural effusion, possibly of pus. Blood examination (2-11-'02) gave H., 93%; r.b.c., 5,264,000; leukocytes, 8,400; polymorphonuclear cells, 96%. No other pathological changes. Pleural puncture was made, but no fluid was obtained. From this point on the patient improved steadily and rapidly. This case showed the condition of affairs that one would naturally expect with a mass of leukocytic infiltration in the chest, and throws light only upon the novel action of the multinuclear cells in inflammatory processes.

CASE V resembled in many ways Case II, in that it occurred in a woman, and also in a typhoid case of weeks standing. After a protracted course the temperature assumed a septic character, the patient appeared exhausted, an intense cystitis was present, and it appeared possible, if not probable, that a purulent collection was present, either as the result of typhoid infection, or secondary to the bladder condition. The physical examination was equally negative with that in Case II. The blood appeared thin, coagulation was slow; H., 48%; r.b.c., 4,160,000; leukocytes, 14,200. The polymorphonuclear cells constituted 54% of the entire number of leukocytes. The Widal test was positive at this time. The case took a sudden turn for the better on the day following the blood examination, and by its subsequent history confirmed the suggestion of the low percentage of polymorphonuclear cells

that neither pus nor active inflammatory influences were present in sufficient force to overcome that exerted by the typhoid infection in depressing the number and polymorphonuclear percentage of leukocytes. From that time on the convalescence was steady and complete. This case was studied not long after the discovery of the purulent collection in Case II, and with the latter constantly in mind. The presence of 14,000 leukocytes, with a polymorphonuclear percentage of only 54%, will be considered subsequently in connection with the second point of our discussion.

This paper was nearly ready for publication when a sad and most striking instance of the occurrence of a high polymorphonuclear percentage with a steadily decreasing absolute leukocytic count, marked the almost certain time of perforation of the bowel in a physician well-known to the profession and the public, and an intimate and cherished friend of the writer.

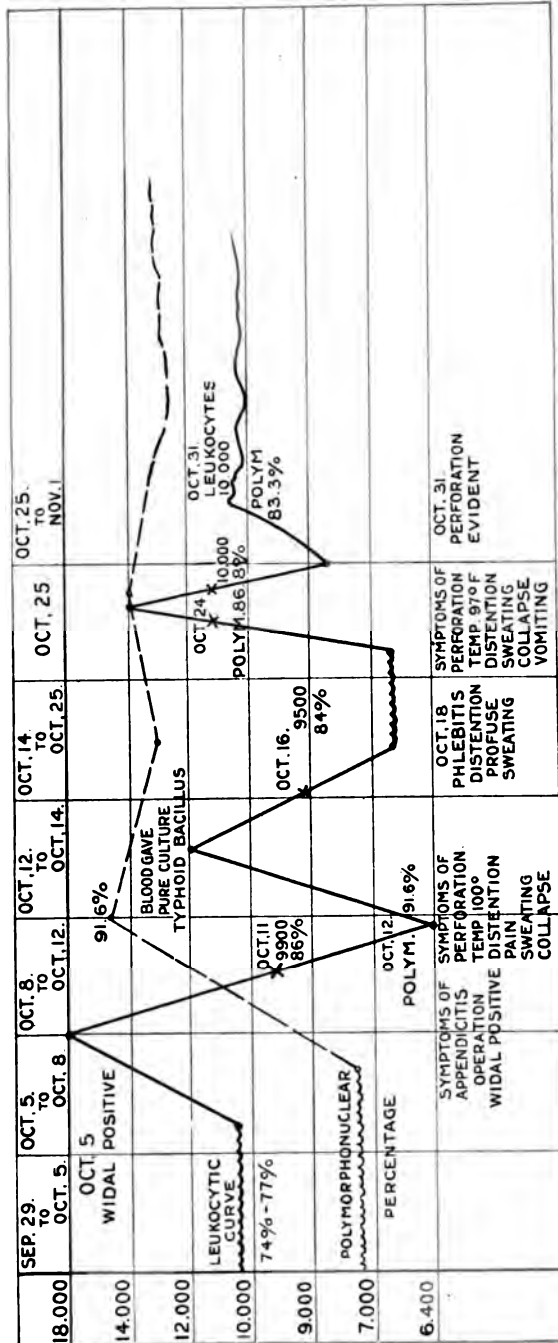
CASE VI.—A physician, 39 years of age, with a previous history that was negative except for a slight recurrent bronchitis, and for several undoubted attacks of appendicitis during the past 18 months. The writer saw him on 10-1-'02, and realizing that he was facing a serious illness, on the following day, because of close personal associations, transferred him to the care of Dr. Morris J. Lewis. The history of the past 2 weeks indicated typhoid fever or a latent, increasing appendicitis or both. The blood picture when first seen on 10-1-'02 was H., 73%; r.b.c., 4,880,000; leukocytes, 10,200. No malarial organisms. No pigmentation of leukocytes. No poikilocytosis. No differential count made. Widal test negative. On the following day the symptoms and physical signs suggested appendix trouble. The leukocytes numbered 10,400, and again 10,600. The polymorphonuclear count, however, showed only 74%, and of small lymphocytes 17%. Both of these blood examinations were made by the writer. On 10-2-'02 Dr. Longcope examined the blood. The clinical symptoms still pointed to appendix involvement, rather than typhoid only. The Widal reaction was not yet perfect, though suggestive. On 10-5-'02 doubtful spots were found; the appendix condition for the first time appeared secondary. The blood was again examined by the writer, who found the Widal test for the first time positive. The diazo reaction was strongly positive. The leukocytes numbered 9,800; the polymorphonuclear cells, 77%; the small lymphocytes were still 17%. On 10-7-'02 the leukocyte count rose to 14,900, and on the following day to 18,400. There was increasing tenderness in the right iliac fossa and marked rigidity of the right rectus muscle. The appendix was removed. (A pathological description of the organ will be duly reported by Dr. Lewis. It is sufficient to say that it presented unmistakable evidence of both chronic and acute inflammation.) The Widal test was again positive. On 10-9 the leukocytes numbered 14,300; on 10-10, 14,100; on 10-11, the temperature was 104°F.; there was a marked chill; and the leukocytes fell to 9,900; the polymorphonuclear count was 86%. No malarial organisms could be found. On 10-12, marked signs of weakness; temperature fell to 100°F.; pulse feeble; profuse

sweat; extreme abdominal distension and pain; leukocytosis. *Polymorphonuclear percentage*, 91.6%; small mononuclear forms, 4.2%. On 10-13, blood gave a pure culture of the typhoid bacillus. 10-14, wound opened in the lower portion; marked distension; profuse sweating; leukocytes, 10,300. 10-15, leukocytes, 7,700. 10-16, leukocytes, 9,500; polymorphonuclear forms, 84%; small mononuclear cells, 10%. 10-18, profuse sweating; both legs slightly tender and swollen; leukocytes, 7,300. 10-20, leukocytes, 8,800; no malarial parasites found. 10-22, marked distension and abdominal pain; leukocytes, 10,000. 10-23, much distension, apparently confined to the colon; leukocytes, 8,300. 10-24, marked distension; leukocytes, 10,000; polymorphonuclear cells, 86.8%; small forms, 8%. During this day and the next severe pain in the left abdomen. Extreme distension; considerable clear fluid removed from the abdomen; vomiting; temperature fell to 97°F.; leukocytes, 14,100. 10-26, condition much improved; wound healthy; serum sweet; leukocytes, 9,300. Extreme distension; phlebitis distinct; leukocytes, 12,250. 10-29, pain in left abdomen severe; leukocytes, 8,600. 10-31, pain on pressure to left of umbilicus; appearance of collapse; gas and fecal matter escaped from wound on examination. Leukocytes, 10,100; polymorphonuclear cells, 83.3%; small mononuclear forms, 13.2%. Operation. Large perforation (size of half dollar) in under portion of transverse colon, and surrounded by a gangrenous area. Region around perforation appeared closed off by exudate and adhesions. Death occurred on the following day.¹

CASE VII.—The last case to which reference will be made is one that came under observation also within the last few months, illustrating the same point though in a different way. A woman, aged 38 years, of nervous habit, with a history of longstanding abdominal trouble. During the previous 2 years she had passed considerable quantities of blood in her urine and a lumbar operation was performed and a movable kidney sutured in place. Since that time there had been constant and distinct signs of appendicitis until the autumn, when the patient was barely able to keep her feet. She was affected physically, nervously and mentally, and the right side of the abdomen was constantly rigid. With the progression of the case every symptom appeared to point to a collection of pus in the abdomen. The patient was delirious, the temperature that of a septic type, the abdomen rigid and the history of a longstanding and neglected appendicitis made the diagnosis of pus probable. The blood was examined just prior to the operation, with a view to confirming, and with no thought of questioning, the presence of pus. The blood picture was r.b.c., 4,010,000; leukocytes, 9,400; polymorphonuclear cells, 89%. No poikilocytosis or other pathological changes of the red cells. It was agreed before the abdomen was opened that if pus were present under the existing conditions there would probably be present a higher percentage of polymorphonuclear cells, and that the actual percentage (89%) could be accounted for by a simple inflammatory condition. This was found to be the case, and the operation revealed a long, chronically thickened appendix, containing about one-third of a teaspoonful of serous exudate.

¹ These notes are inserted owing to the courtesy of Dr. Morris J. Lewis, who will report the full clinical history elsewhere.

CASE OF TYPHOID PERFORATION—CHART OF LEUKOCYTIC VARIATIONS.



Of course in the light of the cases cited in this paper conclusions will, and should be drawn. And yet conclusions should be carefully drawn or not at all. There is no one who will be tempted to say that we know or understand more than a fraction of the significance of relative leukocytosis. And yet again it seems certain that there is present in such a series of cases a pointed trend toward a connection between severe inflammatory conditions, which appear in a system undermined and threatened with collapse, and a high polymorphonuclear count, *especially in the presence of a marked decrease (gradual or sudden) in the absolute leukocyte count.*

The most rational explanation of the fall of leukocytes, and the persistence of a high polymorphonuclear percentage in cases of this nature appears to the writer to be the following:

In all inflammations and infectious processes the first and prompt tendency is toward phagocytosis, and in the procedure both the total number and the polymorphonuclear percentage of leukocytes increase. It appears that as long as the resistance of the body holds out the total number of leukocytes remains in excess of the normal. When tissue resistance gives way phagocytosis becomes less active, though not entirely done away with, and the total number of leukocytes diminishes. As long as phagocytosis is at all apparent, however, it shows in the increased percentage of polymorphonuclear forms, and at times this is excessive, even when vitality is so low as to be unable to furnish the slightest absolute leukocytosis. In other words, all the forms of leukocytes are diminished, owing to the lack of phagocytic energy, which is dependent upon the loss of vitality in the tissues. Of those leukocytes that still remain, there must be a proportional excess of the adult forms as long as any tissue energy persists, since these forms are most actively concerned in the protective processes of the body and are most in evidence at such a time. It cannot be assumed, because there has been an excess of polymorphonuclear forms, that when the total number falls, the polymorphonuclear forms only *remain* in excess. This is by no means the case in simple pleural and peritoneal effusions, in evident pus collections or in pneumonia; on the contrary with the decrease in the total number, the polymorphonuclear percentage also falls or, as in Case IV the polymorphonuclear percentage falls, with even a rise in the total number of leukocytes. Case VI seldom showed an absolute leukocytic count of over 10,000 and only once did it rise to 18,000. For the greater part of the time, however,

with a constantly low numerical count (4-10,000) the polymorphonuclear percentage averaged over 85 per cent., and at the probable time of perforation registered 91.6 per cent., with a total numerical count of 6,400.

Case VII showed no absolute leukocytosis, a decided though not extreme polymorphonuclear leukocytosis, in the presence of symptoms all of which indicated a purulent condition. Probably the extreme depression of the patient was the cause of the absence of an absolute leukocytosis. Certainly, I think the appendiceal inflammation accounted for the polymorphonuclear leukocytosis, though in the absence of a numerical total increase, and the fact that this polymorphonuclear percentage remained a moderate one (as has not appeared to be the case in the presence of pus) was of decided interest in the light of the actual findings.

At just what point to call the condition a significant polymorphonuclear increase presents a serious question. It seems safe to say that the cases already studied indicate 80-85 per cent. of polymorphonuclear cells as a suspiciously high percentage, and in the absence of an absolute leukocytosis a very serious one. Over 90 per cent. would appear to be still more indicative of active and grave inflammatory processes and usually suggestive of purulent or other leukocytic exudates or effusions. Pneumonic consolidations give this picture, as may also acute and chronic pus collections and nearly all septic intoxications. If in any of these conditions the absolute leukocytosis disappears, and the polymorphonuclear percentage continues high, we have a warning of overtaxed powers of resistance. As all powers finally give way even the polymorphonuclear percentage must fall, as it is the last sign of a worn out energy. It is not safe to form iron-bound rules for new principles; but, if any new principle seems to be well-grounded upon fact, it is the one that urges scrupulous attention to a patient whose leukocytes show a high polymorphonuclear count in the absence of an absolute leukocytosis.

ABSOLUTE LEUKOCYTOSIS.

Far less need be said at the present time in regard to the occurrence of an increase in the total number of leukocytes in the blood under inflammatory and similar conditions. There is still in existence as there always will be, a small body of men who persist in striking at the phantom of a leukocytosis that will *diagnose* a case or *decide*

difficult operative questions. Needless to say they will wear themselves out in the effort and with no injury to the ghost that never assumed material form. The great mass of clinicians (and this term includes distinguished clinicians as well as a large class of so-called country doctors that are not a whit behind the city men in energetic and up-to-date methods of medical diagnosis) is learning to look upon the occurrence of an absolute leukocytosis as only a clinical symptom, though sometimes a very significant one. It may occur in slight degree in absolutely healthy persons; it may also point to a fatal condition. In every instance the particular individual and the particular leukocytosis must be considered together in order to obtain any value from the study, and in order to avoid error. In many cases nothing new will be learned from the examination of the leukocytes; in many others invaluable information will be derived. Moreover, it cannot be denied that in certain conditions even a pus collection may be so nearly walled off from the general circulation as to have no serious effect upon the processes required for a seemingly healthy existence. Such an instance is seen in occasional large abscesses of the liver, especially the tropical form, which are known to have existed, beyond shadow of doubt, within active persons for years before evacuation. Sometimes these fail to cause an absolute leukocytosis even though the resisting powers of the patient are good and the explanation of its absence must lie in the fact that a membrane of such density as to protect the circulation from the influence of the purulent process must in like manner prevent the very process necessary to the production of a leukocytosis. Just as fever, pain and swelling may all be absent in the presence of a pus collection surrounded by a dense fibrous membrane, so the absolute leukocytosis seems occasionally to fail, and for the same reasons. The writer has as yet, however, never seen a case of so-called walled-off abscess in any portion of the body that failed to present a relative leukocytosis of the polymorphonuclear cells.

It seems hardly necessary to state that the leukocytes vary normally from 5,000 to 10,000 in a single individual, and that digestion and exercise are two of the most common causes of such variation. Any text-book on the blood will advise the reader that a leukocytosis, to be significant, must be of decided proportions, and certainly an increase over the number normal in a given person. The majority of text-books, however, fail to state that the presence of a leukocytosis is one clinical sign, and that there is no clinical sign known to-day

whose value is not to be estimated as part only of a complex picture. The fact is also usually overlooked that one examination of the leukocytes is not only unsatisfactory, but often misleading; and that frequent and even constant examinations must be made in order to obtain the full and certain value of any study of the blood. No number of leukocytes can be fixed at which we can say that pus or any other inflammatory or infectious condition is present. In one subject 20,000, in another 50,000, and in another double that number of leukocytes will be found suggesting identical conditions, and yet each of these figures is suggestive of a certain order of process that will be still more strongly indicated by the complete clinical picture. There has never been a more untrue accusation than that the students of leukocytosis are endeavoring to decide upon operative measures, and make diagnoses that will rest solely upon the blood picture. Such accusations are always made by men who have heard and believed the enthusiastic beginner, or who hear half a statement and lose the gist of the argument because they have not had time or interest to listen carefully or well. Such men make serious mistakes, as the result of a misuse of a valuable clinical sign, and lay the blame for a result for which they themselves are solely responsible, at the door of an innocent and valuable measure.

Perhaps one of the most pertinent suggestions given by an increase in the total number of leukocytes is obtained when constant examinations show either a persistently high count, accompanied by symptoms and physical signs that point to a localized process; or a gradually, but steadily increasing count (total) under similar conditions. A gradually falling leukocytosis *usually* indicates a bettering of the general physical condition. We have already laid sufficient stress upon the study of the polymorphonuclear percentage to fear that this last assertion will be misinterpreted. Occasionally every physical sign and symptom will abate and improve, and the total number of leukocytes fall to or below normal, though the actual condition is one of grave seriousness. In such cases the relative leukocytosis may be relied upon to warn of impending danger; at this point all clinical symptoms and signs fail. Procedures must, in the light of our present knowledge, be undertaken that may not seem clearly warranted, and with the full knowledge that the interior of the body presents riddles that cannot always be deliberately solved. Any and every leukocytosis should be looked upon with grave suspicion, but with the full knowl-

edge that it is only one clinical sign, and that clinical signs are only signs after all. The prevailing wind may cause them to point in the wrong direction. When this is fully realized the so-called dangers of blood study will have been lost sight of, and certain reluctant semi-students will fall into the line of those who use to full advantage every form of leukocytosis that may be found present after a number of thorough examinations of the blood have been made. They will then no longer insist either that the breath sounds are always absent over a pleural effusion or that a leukocytosis, when properly studied, is misleading. The experience of men who are to be trusted has too often proven both of these beliefs to be without foundation.

The final and all important question is, "Of what clinical value is a leukocytosis to the practitioner?" The experience of the writer at the bedside and the laboratory leads him to answer as follows. As long as the clinician considers; first, the physical signs, then the temperature chart and the history of the case, and lastly, the report of the laboratory examinations of all obtainable excretions and secretions, and finally, all three in their proper relation to one another,—just so long will he find the presence of a leukocytosis, whether absolute, relative or both, of inestimable aid. Its presence or absence should never, let it be once again repeated, alone decide in favor of one diagnosis or form of treatment or another; or persuade the surgeon to operate unless other indications of convincing nature are present. But in their presence such evidence as a marked absolute or polymorphonuclear leukocytosis must assuredly bear great weight; and when followed day by day—as it should be in a serious case—a leukocytosis may point to the correct solution of a grave problem. Who knows but that what we have learned from the behaviour of the leukocytes in cases such as have been presented may not save to us precious lives such as that so recently lost to the medical profession and the world at large. Experience and desire were at a loss to ascertain either the state of affairs within the abdomen or the proper course to pursue; another hint in such a case is beyond price. In a sudden rise or a steady gradual increase from hour to hour or from day to day, we have a sign-board that means danger, and points to a careful study of physical signs. A leukocytosis never can indicate pus or any other inflammatory condition and should never be allowed to influence treatment in the absence of other equally convincing evidence. In certain conditions a leukocytosis indicates the retention of considerable

resisting power on the part of the patient, as in pneumonia; and in like manner in the presence of pus, the physician would fear to see the number of leukocytes fall while the purulent collection remained in the body. It is a different matter when the total number of leukocytes is low, and the polymorphonuclear percentage is very high. It may then be inferred that a grave condition is present and it is fair to assume that the polymorphonuclear increase is the indicator of all that is left of resisting power on the part of the body. Let this loss of tissue energy decrease still further and, if the principle hold true, even the polymorphonuclear increase must fall with the complete collapse of phagocytic action.

We have still much to learn from the study of actual cases, but we have progressed far enough to lay hold of certain indications that will be valuable when other signs have failed. It is warrantable to state that no case has as yet been observed in which normal processes have been accompanied by such a blood picture.

ABSOLUTE LEUKOCYTOSIS IN THE ABSENCE OF POLYMORPHONUCLEAR INCREASE.

Case VI, as already noted, furnishes at least one instance of the occurrence of a moderate leukocytosis (absolute) in the absence of an increase in the number of multinuclear forms. Just what significance to ascribe to this is not easily determined. There were present a typhoid infection that would tend to diminish both the absolute number of leukocytes (which it failed to completely do) and the polymorphonuclear percentage, and also a cystitis that would have the opposite influence. The result seems to have been a compromise. Probably the typhoid infection was by far the most potent influence and certainly it was the one that at that time dominated the system. The cystitis was also, no doubt, of typhoid origin; and yet the pus formation must have been so local in its influence and so completely drained, through the ready outlet through the urethra, that the suppuration had little or no influence on the general economy in comparison with the typhoid poison. Occasional cases of typhoid fever, and in fact certain normal persons, present an average leukocytic count of several thousand above the customary figure (5,000-10,000) and 14,000 in this case may not have been a leukocytosis. It appears more likely, however, that it did represent the slight influence of the local suppuration upon the blood and tissues, held in check by the

typhoid infection. Other and similar cases have been noted in which the absolute leukocytosis was even of a less degree and, therefore, even more questionable.

The following conclusions seem warranted:

(1) The term leukocytosis must include every increase in the absolute number of the leukocytes of the blood examined, as well as every increase in the percentage count of the various leukocytic forms.

(2) A leukocytosis, of whatever nature, must always be regarded as a clinical sign of importance, but never of such weight as to influence against equally convincing physical signs.

(3) A high percentage of the polymorphonuclear forms in the absence of an absolute leukocytosis indicates the presence either of pus or of some grave inflammatory process, together with a low vitality of the patient.

(4) Specific factors may rarely exert such an unusual influence as to interfere with the customary reaction of the polymorphonuclear cells. At least one instance has been noted in which the total number of leukocytes was increased, at the same time with a marked reduction in the number of polymorphonuclear forms. This condition is, probably, seldom encountered.

(5) Single counts of the leukocytes, or single estimations of the leukocytic percentages are often misleading; while a persistent series of observations will seldom fail to aid in the diagnosis and treatment of the condition.

(6) A gradual, but steady, rise in the total count of leukocytes above the customary number, usually indicates the presence of an active and augmenting inflammatory influence. When this increase reaches large proportions it may be looked upon as an indication of the presence of an active leukocytic process (serous or purulent effusion, localized pus collection, pneumonic exudate, etc.) provided the clinical picture also bears out the suggestion.

PROCEEDINGS
OF THE
Philadelphia County Medical Society.

**SYMPOSIUM ON THE THERAPEUTIC STATUS OF THE
COAL TAR PRODUCTS.**

[December 10.]

**The Therapeutic Status of the Coal Tar Products in Neuralgia
and Other Painful Conditions.**

BY WHARTON SINKLER, M. D.

In the history of therapeutics, there is probably no drug which has been so much used and so greatly abused, as have the coal tar derivatives since their introduction. When first used therapeutically, the aniline products were employed as antipyretics, their power to reduce temperature having been noted in experimenting with them and the names originally applied to these preparations indicate their supposed greatest usefulness. For example, antipyrine, antifebrine, etc. It was soon found, however, that although by the administration of coal tar preparations in fever, there were produced sweating and a decided drop in temperature, in addition to these results, there was a decided analgesic action. The headache and neuralgic pains which accompanied the febrile condition for which the drug was given, became markedly lessened. However, the preparations soon fell into disfavor as antipyretics as the result of the untoward effects produced by them. In fevers their depressant action more than counterbalanced their value in the reduction of temperature, for in doses sufficient to lower the temperature in fever, they act as paralyzants on both the motor and the sensory nerve fibers and are, therefore, dangerous in fevers of a systemic type like typhoid.

Antipyrine, the first of the coal tar preparations which was employed therapeutically, was experimented with by Professor Filehne, of Erlangen, in 1884, who observed its properties as a febrifuge, hence its name. As it is a proprietary preparation it has never been recognized in the United States Pharmacopeia, but it is official in the British, under the name of phenazone. In 1887, Germain Sée reported that he had used it in painful nervous disorders like migraine and neuralgia, but he seems to have used it in huge doses; recommending forty-five to ninety grains *per diem*, which is more than one would now venture to give. Since that time, the preparation has been used largely for the relief of pain of all kinds, and for a few years immediately following its use by Sée, it was highly popular, but many medical men objected to prescribing it on account of its being a patented article.

In 1886, acetanilid was introduced by Cahn and Hepp and at once came into favor. It was asserted that the preparation possessed all of the merits without the disadvantages of antipyrine. Like the latter drug, it was first regarded simply as an antipyretic and was given the name antifebrine by the manufacturers who patented it when they put it on the market. As early as 1886, Lépine wrote of the action of the drug as an anodyne and nervine. He especially recommended it for the relief of the pain of tabes and stated that he had also found it of value in the treatment of the gastric crises of that disease.

Dujardin Beaumetz, in 1889, wrote favorably of the action of this drug in diseases of the nervous system, especially in neuralgia and in the pains of locomotor ataxia. Demieville, in the same year, reported favorably on its use in sciatica and other neuralgic conditions. Other writers confirmed their satisfactory reports, so it is little to be wondered that the preparation rapidly found favor and that other products of coal tar were eagerly sought for, which might prove of value. As a result, there have been put on the market many other preparations, most of which have been proprietary. Phenacetine, exalgin, thallin and other products of coal tar have been introduced and used to a greater or less extent. Phenacetine has enjoyed almost as great favor as the two first discovered, but so far, nothing has exceeded acetanilid in the extent of its use. Of the almost innumerable preparations which have been advertised for the relief of pain, at least nine-tenths have for their basis and chief efficacy, acetanilid. The various head-

ache powders, pain-cures and cure-alls, all contain more or less acetanilid mixed with other substances. The selection of this drug from the coal tar preparations is partly due to its cheapness, but it is mainly on account of its superior efficacy that it is used. The indiscriminate use of headache powders which contain acetanilid has in a number of instances, caused marked evidences of aniline poisoning, and more than one death has been reported as a result of these preparations.

The legitimate use of the coal tar products has increased each year, with the introduction of new preparations. Like all new drugs, marvelous powers have been ascribed to them and in a wide field of diseases, but at the present time, when administered internally they are used chiefly for the relief of pain. It is to be remembered, however, that they are of comparatively little value in pain other than that of nervous origin. The affections in which the coal tar products have been found to be of greatest usefulness, are migraine and other forms of headache which are not organic; sciatica, lumbago, trifacial, intercostal and other neuralgias; the pains of locomotor ataxia and in ovarian and visceral pains.

It is well-nigh impossible to enumerate all of the aniline products which have been introduced in the past twenty years with the purpose of the alleviation of pain. Among the most prominent are the following: antipyrine, acetanilid, exalgin (methyl acetanilid), phenacetine (para-acetphenitidin), thallin, saliprin (antipyrine salicylate), phenocoll, lactophen (similar to phenacetine, but a lactic acid radical replaces one atom of hydrogen), citrophin (also similar to phenacetine, but in which one atom of hydrogen is replaced by a citric acid radical), methyl blue, sulphonal and trional. The salicylates are also most important remedies in the treatment of neuralgias and pains of a similar kind. Although they are in some instances obtained from oil of wintergreen, they are generally prepared synthetically from coal tar and possess the peculiarities of aniline. In addition to the salicylates of sodium, strontium and ammonium, we have salol, salophen and aspirin. The above named preparations all have greater or less value in painful affections of nervous origin. Probably the most reliable of these are those which were first introduced; namely, antipyrine, acetanilid and phenacetine. These have indisputably borne well the test of time. The salicylates are old and trustworthy remedies for the alleviation of pain and they have the great merit of being almost nontoxic. They have the disadvantage, however, of being liable

to disorder the stomach, and in affections like migraine, in which there is usually nausea, they are especially objectionable. One of the recent preparations of this class, aspirin, is efficacious in much smaller doses than sodium salicylate and has a distinct value in neuralgias and other nerve pains.

It may be out of the scope of this paper to refer to the unfavorable effects of the coal tar derivatives, but this should always be borne in mind, and one should also be careful to remember that some persons seem to have an idiosyncrasy as to these preparations. A case is on record in which cyanosis, syncope and death have followed a single dose of five grains of acetanilid. I have seen a case in which extreme cyanosis but no other unfavorable symptoms followed the dusting of between twenty and thirty grains of powdered acetanilid over a blistered surface. Cutaneous eruptions, usually urticarial, sometimes follow the administration of antipyrine and phenacetine. The more grave consequences of the aniline preparations are profuse sweating, cyanosis, exhaustion, oppression and collapse.

It is now customary to administer with these preparations, caffeine, which acts as a cardiac stimulant and counteracts the depressant action of the drug. Ammonium carbonate and monobromated camphor are also given in combination with the coal tar preparations with the same object.

In conclusion, I would say that so far from falling in esteem, the coal tar derivatives are now more relied upon for the relief of pain by the medical profession than ever before and will continue to be so until this progressive age develops some better remedy.

Coal Tar and Its Derivatives in the Treatment of Diseases of the Skin.

BY M. B. HARTZELL, M. D.

Although a large number of substances derived from coal tar have at various times been recommended for the treatment of diseases of the skin, the number actually in use at the present time is a relatively small one since the great majority of them, when brought to the test of extended use, have failed to justify the more or less extravagant claims of enterprising manufacturers or enthusiastic, and oftentimes

too credulous, investigators. Of those in present use only a small number can be said to be remedies of choice, the remainder being employed as a sort of last resort when the older remedies fail.

The coal tar products possess, among other properties, two which suggest their use as local applications in many diseases of the skin: they are nearly all more or less inimical to the lower forms of life, which play a prominent role in a number of cutaneous diseases, and they are analgesic to a greater or less degree when applied locally or taken internally; and these two properties represent their chief claims to employment in dermatology.

I shall not attempt in this short paper to enumerate all the derivatives of coal tar which have been employed in the treatment of diseases of the skin, but shall very briefly refer only to those which may be said to have established a reasonable claim to consideration by relieving more or less effectually some of the troublesome symptoms of various cutaneous maladies.

As liquor carbonis detergens, coal tar saponine, coal tar Le Boeuf, coal tar itself has been used for some time in the treatment of diseases of the skin with success, especially in those in which the ordinary wood tar has been found useful, such as chronic eczema with marked thickening and scaling. In this disease it diminishes hyperemia and affords marked relief to the itching which is so frequent and troublesome a symptom. Indeed, in the opinion of no less an authority than Mr. Jonathan Hutchinson, it is the most generally useful of all the remedies employed in this affection; and Leistikow declares that it relieves itching as no other remedy does. The latter finds the simple alcoholic solutions more effective than the combination with tincture of quillaia which is used in the preparation of the liquor carbonis detergens, and uses the following formula:

R	Olei lithanthracis,	30.0;
	Alcohol, 95 per cent.,	20.0;
	Ether,	10.0.
		M.

My own experience with this remedy leads me to value it highly in the treatment of chronic eczema and, to a less degree, in psoriasis. It may also be used as an ointment, the best vehicle for this purpose being, according to Leistikow, the unguentum caseini of Beiersdorf.

Carbolic acid, one of the earliest employed of the coal tar products, is one of the most generally useful of the entire series on account of its anesthetic effect when applied to the skin. Although an active parasiticide, it is not much employed in the treatment of parasitic affections because of the introduction of more active and more agreeable remedies of this class. Because of its benumbing effect when applied to the unbroken skin it finds daily use in the treatment of that very large class of skin affections in which itching is a more or less prominent symptom. As an antipruritic it probably has no equal in the whole pharmacopeia, and on this account is well-nigh indispensable to the dermatologist. It may be used either as a lotion or ointment in every disease in which it is desired to relieve itching, alone or combined with other remedies. The following lotion is an admirable one for the relief of itching, whatever its origin:

R_x Acid carbolic; 3ss,
Glycerine, 3i,
Aq. camphoræ q. s. ad., 3iv.
M.

The following ointment in which the carbolic acid is combined with an equal quantity of camphor will be found an excellent application in many itching diseases:

R_x Acid carbolic;
Camphoræ; āā gr. xv.
M. et adde;
Lanolin;
Petrolat. āā 3ss.
M.

As an antipruritic there are few or no contraindications to the use of carbolic acid.

Savill has reported a case of leucoderma, occurring in a girl, sixteen years old, in which pure phenol painted upon the patches caused the skin to resume its normal pink color in three weeks.

The cresols, which are closely akin to carbolic acid in their chemical composition, have been used to a limited extent in cutaneous diseases, as creolin and trikresol, the former probably being cresol emulsified with resin soap. Creolin may be used in the same class of diseases

in which carbolic acid is useful, but according to my own experience it not infrequently proves irritating, especially when used as an ointment.

Trikresol has been highly recommended by McGowan in the treatment of alopecia areata; and more recently Heidingsfeld, who has used a 50 per cent. solution painted over the bald areas, has reported excellent results. The latter believes it the best of all applications in the treatment of this frequently obstinate disease. In several cases comparative experiments were made with this remedy and some of the older ones, and it was found that the growth of hair was much more rapid in the patches treated with trikresol.

Although first obtained from galbanum by Hlasiwetz and Barth, resorcin properly belongs among the substances derived from coal tar, being a diatomic phenol possessing physiological properties resembling those of carbolic acid. Some years ago I called attention to the many valuable properties possessed by this drug in the treatment of disease of the skin, and a longer and more extended experience in its use has only confirmed the opinions then expressed. Used as an aqueous lotion, in the strength of eight to ten grains to the ounce, it is an extremely valuable application in many of the forms of eczema, especially in that variety which has been recently designated seborrheic eczema, allaying itching, diminishing hyperemia and discharge. For some reason about which I am not very clear, it does not seem to answer nearly so well in this affection when employed as an ointment. In the treatment of acne it has no superior, used as an ointment in the strength of forty to sixty grains to the ounce, or even stronger. Although formerly inclined to regard it as inferior to sulphur in the treatment of this disease, a more extended experience leads me to give it first place. In superficial epithelioma, such as seen so frequently upon the face, resorcin sometimes acts most happily in promoting cicatrization, used as a 40 to 50 per cent. plaster. A weaker plaster, 20 to 25 per cent., may be used to promote healing after the destruction of such growths by stronger caustics, such as caustic potash or pyrogallol. Although a fairly active parasiticide, it is rarely used for this purpose at present. Resorcin possesses decided sedative properties, and it may be used with advantage in the treatment of painful chronic leg ulcer; I know of no remedy which affords the same relief in this notoriously intractable disease.

Naphtol, also known as β -naphtol, another phenol derived from coal tar, possesses parasiticide properties much more active than the

phenols already considered. First proposed by Kaposi as a remedy for scabies, it has proven itself a very satisfactory substitute for the drugs usually employed in the treatment of this disease. It is practically without odor, and does not stain, and although it sometimes causes sharp burning when first applied it does not produce a dermatitis such as often follows the use of sulphur. Within the past two years I have used it quite extensively in that very obstinate parasitic affection, ringworm of the scalp, and have found it more efficacious than the parasitocides more commonly used. It rarely causes any irritation of the scalp, even when used in ointments containing from a dram to a dram and a half to the ounce. Apart from its employment as a parasiticide this drug is but little used in the treatment of diseases of the skin. It has been recommended as a local application for psoriasis, but it is much less useful than a number of other substances, and is not likely to find extensive employment in this affection.

Orthoform, a recently introduced coal tar derivative, at first promised to be a very useful remedy in the treatment of painful leg ulcers and other painful affections of the skin in which the terminal nerve-endings are exposed since its application to the broken skin is followed by marked anesthesia lasting several hours. This promise of usefulness, however, was not fulfilled since it was soon found that, while it produced a decided and lasting local anesthesia, its local use was followed in a considerable number of instances by a painful dermatitis, and even in a few cases by gangrene of the skin. My own experience with it was decidedly unfavorable.

Acetanilid, pure or diluted with some inert powder, such as zinc oxide, talc or starch, has been found useful as a dressing in ulcers and burns, relieving pain, preventing suppuration, and promoting cicatrization. While possessing undoubted antiseptic and sedative properties, it has the serious disadvantage that it sometimes produces decided toxic effects, as shown by cyanosis and symptoms of collapse, through absorption, even when applied to a comparatively limited area. While no doubt useful, it has not come into general employment.

Epicarín is a recent addition to the list of parasitocides derived from coal tar which is said to be nontoxic and unirritating. It has received the endorsement of Kaposi as an efficient remedy for scabies. Further experience is needed to show whether this remedy deserves a permanent place in the armamentarium of the dermatologist.

Some of the aniline dyes, such as pyoktanin or methyl blue, methylene blue and fuchsin, have been used with asserted good effect in simple and malignant ulcerative diseases of the skin. Elliot has employed an ointment containing from one to five grains of fuchsin to the ounce in Paget's disease, and found that it not only relieved pain, but promoted cicatrization of the ulcerated area. I am not aware, however, that other observers have obtained equally favorable results.

A small number of drugs of coal tar origin belonging to the group of analgesics have been used internally with a considerable degree of success in the treatment of diseases of the skin, chiefly those in which itching or pain are prominent symptoms. Arnstein and Antoniak have reported two cases of chronic pruritus in which the internal administration of antipyrine acted most favorably. In the first case the disease had lasted four months, but disappeared in ten days when antipyrine was given twice a day. The second one was a case of senile pruritus, often an obstinate and distressing affection; in this case moderate doses of antipyrine given four times a day caused the disease to disappear in two weeks.

Phenacetine and acetanilid have given me excellent results in chronic urticaria, seven or eight grains of the former, or four or five grains of the latter with an equal quantity of sodium bicarbonate being given four times a day.

From the foregoing it is evident that the coal tar drugs form a small but important addition to the therapeutics of diseases of the skin. While a large proportion of those presented for trial, when weighed in the balance of experience, have been found wanting, a respectable minority have found a permanent place in dermatotherapy, and are in almost daily use.

The Therapeutic Status of the Coal Tar Products in Central Nervous Affections.

BY F. SAVARY PEARCE, M. D.

The subject that has been assigned to me in the discussion this evening, is one of intense interest though of undoubted difficulties, since the use and abuse of these drugs, of the utmost value in medi-

cine, are to be singled out and should be presented to you in a practical way, so that the indications for the use of them in general, and for single ones in particular shall be made plain in the legion of functional and organic diseases involving the central nervous system, to which my subject is limited. It will be my endeavor to present the sum of clinical facts gleaned in the past decade from a somewhat varied experience in general and special medicine, together with the application of data gotten from many sources among excellent practitioners from different parts of the United States. As before stated, it is a difficult task to directly express the happy balance of opinion in the use of the coal tar group in disease of the nervous system; especially when so many widely different opinions seem to come from men of repute. I would like to preface more detailed remarks by the statement that these products, after all, have their physiological and pathological action in the main through impression of the central nervous system, and that a disease even of the lung or a general infection, is influenced by the coal tar products largely as they affect the centers governing trophic nerves; as they control or depress vasomotor competency; or according to the so-called reflex impressions made by them upon an organ or part, existing in health or disease surely; but as yet almost one of the great enigmas to fathom.

IN FUNCTIONAL CENTRAL NERVOUS AFFECTIONS.

Neurasthenia is a disease in which headache in some cases may be almost a monosymptomatic sign. It is here that treatment directed toward the headache alone as in correcting the eyes when not carefully found to be the cause of the pain will often prove to be a snare, and analgesics of any kind will not permanently relieve such distress. Hence the responsibility the physician entails in treating cases of vague pains in the head, and the urgency therefore, of determining accurately the etiology of the pain in which the study of the type, whether shooting, boring, throbbing, constricting or not, is most important. In reference to pain in neurasthenia, I would like to refer to the intense aching in the lower spinal region; and we have seen this symptom diagnosed as rheumatic in origin where the various analgesics were of course used without effect; the antirheumatic drugs having been previously sought in vain. The sad picture of the helpless patient in manifest distress being further goaded on, by the drug habit formed of these cardiac depressing coal tar products,

which in turn disturb metabolism, disorganize the blood and depress the important centers of the medulla, is one of the most difficult to unravel which is encountered in medicine.

As an instance of this, I can recite a case referred to me by Dr. C. B. Dotterer, on October 20, 1902, in a man aged 27. This patient gave a history of being perfectly well until 14 years of age at which time, through overwork, he undoubtedly became neurasthenic and suffered from frontal and occipital headaches which he claimed were relieved by large doses of strong coffee. He had smoked rather heavily but had not indulged in alcohol; there was no specific disease. The man's eyes had been corrected at 22 years of age for hypermetropia without any relief to the headache, and he gradually shifted from one doctor to another; the symptom of pain alone being treated until the 15th physician had been reached. After this he took to "tablets" that I am having analyzed; but at present at least, I feel confident contained 5- or 10-grain doses of antipyrine. He had taken these tablets for the past 3 years on his own account, purchasing them at a pharmacist's; and up to the time he came for consultation was taking at times as many as 150 tablets a week without any relief to the head symptom. A singular fact is that with all this drug-habit it seems quite clear, the man never became a morphine habitué. The extreme cyanosis the patient presented, the greatly enfeebled circulation, the confusional mental state, the leaky skin and all associated with hurried respirations was a most perplexing group of symptoms to interpret in the absence of organic disease of the central nervous system or of any other organ that we could find. A chance question as to what he was taking led to a solution of the case and the man was promptly placed in the Medico-Chirurgical Hospital, the drug absolutely withheld, guarding his depressed state by tonics and full, simple diet, in addition to which I gave him a capsule containing 1-12 grain ext. cannabis indica; 1-12 grain ext. belladonna; 1 grain ext. gentian, every 4 hours. With this régime, and the moral influence maintained (because I told him that there was no necessity for taking the amount of the drug he had become accustomed to and that in fact it was doing him harm), at the end of a few days, the pain had entirely disappeared; and in a week after he had come into the hospital, we discharged him as practically well.

This patient belongs to a class that the Christian Scientist so-called would herald abroad. There was no doubt in my mind that the pain in the above case was what is very properly designated "remembrance" pain; the sensory neurons becoming habituated to nerve discharge, and the withdrawal of drugs plus the mental impression made upon the man were the most important factors in his prompt recovery after thirteen years of suffering. His mind and physical state quickly recovered normal health after the discontinuance of the too large doses of antipyrine.

Trional in fifteen-grain doses given in hot milk is our best hypnotic.

IN HYSTERIA.

Hysteria is the other functional disease in which there is irritability of the sensory neurons in a certain type of cases, in which the use of the coal tar products, in my experience again, has been overwrought. But there is no need of recording further cases!

It would seem so far that the "status" of these drugs in functional disease of the central nervous system has been presented to you in rather a derogatory light as to their use; but I am wishing to accent rather the abuse of the drugs which seem to be still so flagrant at the present day though in this respect we are improving. Any one looking over the file of prescriptions at the corner drug store will see yet the great preponderance of the use of analgesics over other medicaments. I fear the medical profession has to some degree justified the onus thrown upon it through this sort of lax prescribing, to the smothering up of symptoms in insidious nervous disease especially; for at the end of a fortnight or month to cite as an average case so treated, the symptom of pain returning, e. g., the patient sees the lack of improvement and shifts to the next doctor and finally to the quack in some instances, upon which the latter thrives with great éclat over the failures of the reputable graduate in medicine. So that if we seem to present the darker side of therapeutics in regard to the coal tar products, it is with the hope it may bestir myself and others to a proper appreciation of a far-reaching influence upon medicine and the community; for upon the advanced understanding of the laity real progress depends after all.

IN ORGANIC CENTRAL NERVOUS AFFECTIONS.

In brain tumor, the symptom pain often calls for relief and is one of the most difficult problems to meet. I have found that camphor monobromate, in three- to five-grain doses every three hours, is the most effectual drug. The danger of the use of antipyrine, especially in a growth at the base of the brain, which may by encroachment upon or through reflex inhibition, affect the cardiac and respiratory centers, is to us self-evident, since I have known of its doing harm during such depression in low fevers, as typhoid, with cardiac failure; and have no doubt of seeing its baneful effect in brain tumor. We have seen very marked depressing symptoms produced by even moderate dosage as five to ten grains and sometimes alarming symptoms where the interne

had been careless in overdoing this line of therapeutics, In meningitis with intense throbbing headache, it is undoubtedly better in my experience to resort to remedial measures such as the ice bag, cauterization at the base of the neck or blistering over the scalp; or to relief of the pain through graduated hypodermic injections of morphine, guarded by atropine, rather than in the use of any analgesic whatever. In fact, in cerebral disease of any kind without mentioning further specific organic affections, I would earnestly suggest, it will be best if the patient in the long run be given small doses of coal tar products if required, and shall submit for your opinion as to whether we may not be right in restating the great danger in using large doses, particularly of antipyrine in such cases. Of course we are all willing to agree with our teacher, Dr. H. C. Wood, that antipyrine can be used with valuable results in hyperpyrexia due to cerebral or other disease in which it is often of paramount importance. Again we all know the value of this remedy in some cases of idiopathic epilepsy in which the bromides and other drugs have failed to control the attacks. With these two exceptions, therefore, it would seem best if one of the coal tar products should be used that we resort to phenacetine or acetanilid which are both less depressing than antipyrine. The use of these drugs in neuralgia is not within the scope of the subject allotted me, but before leaving this heading of our subject I wish to emphasize the great value of salol in three-grain doses thrice daily in the symptoms of general nervousness produced by intestinal autointoxication.

IN ORGANIC SPINAL CORD AFFECTIONS.

Tabes dorsalis is the affection in which relief of pain often demands extreme measures, and in which also the patient is very apt to become a morphine habitué if hypodermics are at all employed. The combination of acetanilid, five grains; phenacetine, five grains; caffeine citrate, two to three grains; given every two to three hours from the very beginning of the paroxysm of pain is, when associated with rest and warmth to the surface of the body or a light effleurage, a most valuable régime to pursue. To this should be added in such cases, the suspension treatment for a few minutes, once or twice weekly. Of course morphine will relieve the pain more effectually, but if the patient can be controlled at all, one of the most valuable indications for the coal-tar products in nervous disease seems to me

right here in disease of the spinal cord; since there is not the danger so much that depressing effects may be thrown upon injured nerve centers in the brain, which usually escape involvement.

It goes without saying also that referred pains in spinal cord disease such as pain in the toe or knee, or even a crisis referred to the epigastric region or to the precordium would also be met by the line of coal tar therapeutics indicated above.

There seems to me very little indication for the use of these drugs in organic disease of the central nervous system save to reduce pain and to make the patient more comfortable for the time being. In functional disease, it has been demonstrated to the writer that patients do become the subject of coal tar derivative drug habits, and as in the case cited above, the physicians then are to blame for holding in abeyance the symptom pain alone without using more scientific therapy pursued after the determination of the etiology of the affection.

There is no need to name here, it seems to me, the special drugs to be employed when they are demanded, since the standard textbooks as of Wood and Hare make perfectly plain to us, the specific physiological effects of these analgesic remedies. It should be known that antipyrine is the most depressing of all; that acetanilid comes next in order as to depression on the nerve centers; and that phenacetine is the drug par excellence which will do yeoman service when indications arise. The great line of combinations gotten up by some ingenious manufacturers seems to us delusive, and not of any greater value than using these three cardinal drugs, one might say, singly, or in combination; to thus get what is properly called the "crossed" action. The use of any of them should always be in accordance with the idiosyncrasy of the patient or feebleness of constitution and must always be borne in mind. It is also well to be on guard with diffusible stimulants, or to incorporate such a drug as caffeine in the tablets that may be employed when one is in doubt or not familiar with the case.

In conclusion, I would like to state that the sales of acetanilid have grown materially in the past five years as a note received through the kindness of one of the manufacturing chemists in this city witnesses. I think we will all agree that the coal tar derivatives are still employed beyond proper measure and it, therefore, rests with such a body of men as here represented in the County Medical Society to give approval or not of the stand taken in this paper, if the best

good is to result. The list of combinations and intercombinations in this letter received from the gentleman mentioned, shows beyond doubt the abuse of these remedies for which I am contending only the proper *use* in functional and organic central nervous affections.

"The consumption of acetanilid has steadily and rapidly increased for all of *ten* years. There has been no material change in the rate of this increase during the past *five* years. Indications point to still more rapid increase in the future.

"I speak here, only for that employed medicinally by physicians. The fear of untoward effects which formerly debarred many from employing the drug has largely vanished and prejudice is waning.

"Our records of purchases made each year show two factors in combination—a natural and spontaneous increase and increase by reason of recent special effort to introduce our products to the notice of physicians, hence prove nothing specifically to your purpose.

"Acetanilid has grown in popularity in spite of its many aliases, copyrighted compounds, vaunted substitutes and the like.

"The present bulk price of acetanilid is eighteen or nineteen cents per ounce. The usual price of competing proprietary articles is one dollar per ounce.

"Acetanilid is employed only in dry preparations. It never enters into liquid pharmaceuticals. It is the newest product in the following list. The figures attached show how frequently acetanilid appears in the thousands of items in a recent catalogue of the largest manufacturer of pharmaceuticals in the world as compared with older and very common drugs.

Acetanilid	37
Aconite and alkaloid	66
Aloes and alkaloid	151
Ammonium chloride	21
Arsenic (brom., iodide chlor., etc.)	123
Asafetida	30
Belladonna and alkaloid	175
Bismuth (subn., subg., etc.)	69
Camphor	63
Cinchona (alkaloids and salts of)	290
Ipecac	115
Nux and strychnine	255
Phenacetine	13

"It is to be observed that several of the above enter into very many formulæ in fluid and solid preparations.

"Such as belladonna, cinchona, strychnine, etc. All these have been counted each distinct use of the drug named being considered. The figures were obtained by actual count and the catalogue used was that of Parke, Davis & Co.

"Not a single line of this refers to acetanilid used in making 'headache powders' for selling to the common people. This use alone must be very considerable. It is as a rule bad, the doses being large.

"Trusting these notes may prove of some service and thanking you for the pleasure of writing them, I am

"Respectfully yours."

DISCUSSION.

DR. J. P. CROZER GRIFFITH said that whereas the different remedies under discussion may all be called *coal tar* derivatives, yet he believes it is incorrect to refer to all of them as *aniline* derivatives. Aniline is itself derived from benzol and benzol from coal tar, and a certain number of remedies are in turn derived from aniline and preserve a portion of the name in their own, as for instance, acetanilid, benzanilid, etc. A number of other remedies, to which reference has been made in the papers of the evening, are not derived from aniline but from another of the coal tar series, namely, carbolic acid, and these preserve the name phenol in their own, as for instance, phenacetine, phenalgine, salophen, etc. Antipyrine, he thinks, belongs to the phenol group also. He said that aniline has a certain distinctive poisonous effect upon the human organism and its derivatives have the same to a modified degree. The compounds of the phenol series have certain other effects which, even though harmful, are not the same as those of the aniline group. We shall make a mistake, therefore, in speaking of this phenol group as derivatives of aniline, and in expecting the toxic symptoms which they might cause to be similar to those of aniline poisoning. He expressed the belief also that whereas the coal tar derivatives of the antipyretic class are seldom needed to reduce temperature, yet there has been too great a reaction following the former overemployment of them, and as a result many physicians have an unwarranted fear of them. As with all powerful drugs, they are at times dangerous, and the improper use of them could be harmful. He thinks, however, that this could not be urged as a reason for abandoning them. There are many cases, especially in children, in which hydrotherapy cannot be employed to reduce temperature without harmful effects upon the patient. In this class of cases the coal tar antipyretics are found of very great value. We should remember, of course, that temperature should never be reduced simply for the sake of reducing it, but because there is some evidence that the elevation is doing the patient distinct harm. It is particularly by a favorable action upon the nervous system, whether fever is present or not, that these coal tar derivatives have proved themselves so valuable.

DR. WHARTON SINKLER in closing said that he is under the impression that antipyrine, antifebrin and phenacetine belong to one class which are the coal tar derivatives, while the salicylates are more strictly of the carboic acid series.

Another Case of Aortic Aneurysm Treated by Electrolysis.

BY H. A. HARE, M. D.

[Read, December 10.]

In 1898, 1900 and 1901 I reported in the *Therapeutic Gazette* cases of aortic aneurysm of the sacculated type in which I had performed electrolysis with improvement in the condition of the patient. I now desire to record another case. In one of these cases the operation was performed three times, in another twice, and in another once. In the present instance the operation was performed twice with a considerable interval. Altogether I have performed the operation eight times. The history of the case is as follows:

The patient emphatically denied specific (syphilitic) infection. Alcohol he had used in moderation. In April of 1898 he enlisted in United States Army, and on May 9, 1898, whilst at cavalry drill at Augusta, Ga., his horse stumbled and threw him forward, the upper part of his chest striking the pommel of the saddle.

The injury sustained at this time he thought trifling, the part only feeling sore for a day or two, and being only slightly discolored. But he also says that at this time he felt a momentary choking sensation about the throat. This all passed away and he felt perfectly well for a week or 10 days, when he had a severe attack of influenza.

His thoracic difficulty immediately followed, manifesting itself by sharp, shooting pains in the chest radiating to the back, between the scapulæ.

These pains continued for about 6 months when they became of a dull, boring, aching character, worse during the day and exaggerated after exercise. After a month's rest in bed, these symptoms disappeared except for a dull, boring pain felt in the middorsal region.

Patient had also complained of more or less cough and had occasionally expectorated small amounts of dark coagulated blood.

During the month of May, 1899, one year after the reception of the chest injury, a tumor appeared in the anterior median line and upper part of the chest, which progressively increased in size.

This pulsated and the superficial veins of chest stood out prominently. The pulsation on palpation was found to be expansile and upon auscultation, a loud, purring bruit was heard. The patient stated that he had no unilateral

sweating of the body or flush of the surface. The ulnar side of the right arm and of the little and the ring fingers of the right hand at times felt numb and dull. Tracheal tugging was also decidedly marked. The patient complained of a dull sensation in his head.

Inspection revealed an egg-shaped tumor in the superior portion and median line, of the chest; to the left of this prominence, as far as the left anterior axillary line, the chest wall was seen to be bulging and decidedly prominent.

Just above the tumor the episternal notch was seen to be unusually deep ($1\frac{1}{2}$ inches). Deep palpation in this notch did not reveal any pulsation.

In the floor of the notch a mass incompressible and almost as hard as bone was also found. Almost the entire manubrium was found to be eroded and destroyed by the tumor.

The costal cartilages of the first and second ribs were also gone, the eroded ends of these 2 ribs stood out prominently and were tender and painful.

A general heaving impulse was seen to radiate from the centre of the tumor in a radius of 3 inches. The sternum was also seen to move upward with each pulsation. The left pulse was fuller and had greater volume than the right, but no inequality of the pupils was apparent.

Auscultation of the tumor revealed a loud churning bruit which was also heard posteriorly and on both sides of the spine, but with greatest intensity upon the right side.

The operation was performed July 10, 1901, at 6 P. M.

The field of operation was surgically cleansed, a small skin incision was then made, and a small hollow needle inserted, through which nine feet of gold wire was passed. Connections were then made with the battery and at 6.10 P. M. the current was turned on, beginning with 5 milliampères, the current strength was increased as shown in the following table:

P. M.

6.10	.. 5	milliampères...	Blood still dropping freely from needle.
6.11½	.. 6	"	....Blood dropping slowly.
6.12½	.. 6	"	....Hemorrhage completely arrested.
6.15	..10	"	....Tumor apparently more firm, pulsation diminishing.
6.20	..15	"	....Tumor decidedly more firm.
6.25	..20	"	....
6.27½	..25	"	....Coughs when current is increased.
6.30	..30	"	....Patient complains of some burning about chest pad.
6.35	..35	"	....
6.37	..40	"	....
6.39	..45	"	....
6.42	..50	"	....Patient becoming restless and starts when current is increased.
6.45	..55	"	....

6.46 ..50 milliampères....Complains of pain, current was now reduced
5 milliampères.

7.00 ..40 "

7.03 ..30 "

7.06 ..30 "

7.09 ..10 "

7.10½..Current stopped. . The needle was now withdrawn, wire severed, and
wound sealed with compound tincture of ben-
zoin.

Even while the operation was being performed the patient stated that as the clot formed, he felt less oppression and could breathe more easily. He left the hospital several weeks after the operation very much improved and returned to his home, where he was married and continued in fair health and without much discomfort for about 2½ months, when, in the space of about 48 hours, the aneurysmal swelling suddenly increased greatly in size at its right hand border, and the enlargement was accompanied by great pain. Shortly afterward he wrote me that "the tumor wired by you is still solid and firm but that the new growth presses on the windpipe." Under my advice he returned to the hospital in January, 1902, about 6 months after the first operation. The area wired at the operation 6 months before was firm and hard and devoid of expansile pulsation. To the right of this area the growth was now rapidly enlarging and I, therefore, wired it a second time in an identical manner with that already described. The skin about the needle was so poorly nourished that it failed to heal over the opening, and some slight oozing took place for some days and finally a superficial slough formed.

Later, becoming discouraged, he returned to Tennessee and made the journey safely. Several days later in writing me of his condition he said, "I arrived home O. K. and I feel very well to-day. I had a hemorrhage about 2 o'clock last night, losing about a pint of blood, and tumor is much smaller. I sat on the edge of the bed and dressed the tumor myself." Later than this, repeated copious hemorrhages from the external wound occurred, the clot covering it having been removed by a local practitioner. The blood was not entirely fresh but escaped in "large clots 3 or 4 inches long." the large clots seeming to enlarge the opening as they were forced through it. Each hemorrhage decreased the size of the swelling, probably diminishing blood pressure and emptying the sac of its clot. "He continued good up to the last day of his life, he looked splendid, and never seemed much weakened by the loss of blood until the second hemorrhage before the last." Finally, a profuse hemorrhage took place from the external wound, which increased in size to that of a quarter, and death took place from this cause.

The conclusions I reach from my experience in this and the preceding cases are as follows:

Electrolysis in properly selected cases of aneurysm is a valuable measure and prolongs life.

The operation itself is neither dangerous nor painful.

The failure of permanent cure does not depend so much upon the failure of the operation to limit the disease locally as to the fact that the adjacent parts of the bloodvessel are weak and, when the most bulging area is solidified by the clot, these lateral areas may later on give way. Even in these cases life is prolonged by the closing of the weakest area and it is not to be forgotten that in at least one case (Stewart's), life was prolonged three years, death taking place from an alcoholic debauch.

DISCUSSION.

DR. D. D. STEWART said that he has operated upon a number of cases of aortic aneurysm, since he first advocated the use of this procedure, in 1888, after a method which he had perfected, and which was now generally adopted in all later cases, including, he believed, those of Dr. Hare. In Dr. Hare's first case his (Dr. Stewart's) technique was followed exactly, Dr. Stewart assisting Dr. Hare in the operation to demonstrate the method. It is important that the anode or positive pole should always be the active one, and in publications of cases this should be stated. He knew of several instances in which the negative current was employed through carelessness on the part of the operator. The negative pole gives a soft, easily-dissolved clot, and if used following the positive, as has been done, tends to rapidly dissolve the coagulum already formed. Dr. Stewart does not now advocate the employment of as strong a current as he did formerly or, if he employs it, it is for a shorter time. If the sac is large his habit is to needle in 2 or more situations, connecting the small coils of wire introduced with the same pole. This tends better to reach all parts of the sac and cause a more general solidification, and thus is avoided a danger he has laid stress upon in several publications, rupture of an unprotected part of the sac through raised blood pressure. He first used gold wire, after experiments with copper and silver wire and then alloys; because he could get a spring with gold and one which would retain its ductility better. Whatever wire is used should be of small caliber and not brittle. He has gone so thoroughly into the improved technique in his various publications on the subject that it is unnecessary to speak further of it here. (See article on "The Galvanic Current in the Treatment of Saccular Aneurysm" in "An International System of Electrotherapeutics." Bigelow & Massey. 2d Edition, 1901.)

DR. ALBERT E. ROUSSEL reported a case of aneurysm of the ascending aorta, which was operated upon by Dr. Edward Martin, at his request, in 1898. He said that at that time he had just returned from Paris where he had witnessed this operation with apparently, at least, temporary favorable results, so that he decided to try it on this patient. The result

was apparently good; but 48 hours after the operation the patient leaned out of bed to reach a glass which was standing on a table near him and the pulsation returned. The patient subsequently returned to his occupation of watchmaker. He lived a little over 2 years from the time that the aneurysm was first diagnosed, which is somewhat longer than the average duration of life under similar circumstances. He does not believe that very much real benefit results from these operations, as not infrequently cases of this condition are seen which survive fully 2 years without any intervention. In one case of which he knows, the patient survived nearly 3 years, so that the prolongation of life, if any, is not very marked as a result of electrolysis.

DR. HOBART A. HARE said that with increasing experience in this operation less wire is being used, which he believes to be an advisable change, as in many of the operations done in former years enormous quantities of wire were used unnecessarily. In the last 2 cases he has operated on he has used much smaller quantities of wire and at the present time, he believes that even a less amount should be used, 3 or 4 feet will perhaps be adequate. He always uses the anode, as the cathode produces liquefaction; and its employment tends to dissolve the clot rather than to harden it; thus defeating the purpose of the operation. He thinks that a current of not more than 30 milliamperes should be used, the exact strength to be determined by the manner in which the mass hardens. He does not feel that the operation is valuable in these cases in the sense that it produces permanent or radical cure, but its importance is manifest in the cases in which the aneurysmal sac is so near rupture, as far as human foresight can ascertain, that nothing can do more than prolong life for a few hours, or days, or weeks at most. In several of the cases which the speaker operated upon the aneurysm was as large as a baby's head, and had one or two spots upon its surface over which the skin was exceedingly thin; in fact it looked thinner than a sheet of isinglass, and seemed as though, if you would put your finger over it, you would cause a hemorrhage. One such case was operated on 3 times, in each instance there was one of these bulging spots which was apparently just about to become ruptured, and the man lived from early spring until the following year, his death being caused by a rupture of the aneurysm posteriorly, where it was not visible and could not be operated upon. The operation does not promise such good results in cases associated with old age and marked atheromatous changes in the arteries, as in the cases of young men, without specific or alcoholic history and with moderately good bloodvessels elsewhere. He thinks that it is only fair to assume that every now and then an aneurysm does exist with a large laminated clot, in which the patient, without any interference, lives for many years. A case of this character was cited. It is important that the needle be properly insulated as, if this is not done, there is danger of injury to the surrounding skin during the operation, thus weakening it, giving rise to the danger of subsequent rupture. Much care should be taken in the use of the large clay electrode, as otherwise it is liable to burn the patient's back.

Report of a Case of Twin Pregnancy, Polyhydramnios and Anencephalic Monstrosity.

BY ANNA M. REYNOLDS, M. D.

[Read December 23.]

J. M. aged 24 years, primipara; married one year; slight in stature; mentally, slightly below normal. I have personally known her for 12 years. She has never been robust but has enjoyed fairly good health all her life. She has one marked peculiarity and that is an insatiable desire to eat paper. Her first choice is colored advertisements, then brown paper, then newspaper. She has had several attacks simulating impaction of the bowels. On 3 occasions I thought she would have to be operated on, as the symptoms caused by the paper resembled an attack of appendicitis. After the attack the bowel movements looked like the pulp one sees in a paper mill. If there is anything in maternal impressions she may be a sufferer, for while her mother was pregnant with her she would have starved had it not been for the kindness of a neighbor. The periods began at 13; were regular, painless but profuse.

FAMILY HISTORY: Father, 2 brothers, and 3 sisters living. Her mother died of neglect. Grandparents were healthy and lived to an old age. Her father is 58 years old. I have attended him for most of the ills found as a result of the abuse of alcohol, and disturbances of a specific nature. During the patient's pregnancy I was much interested in her condition, and had frequent opportunities to inspect and examine her, but as the abdomen was so large all examinations were necessarily unsatisfactory. I always thought it was like trying to locate a small object in a large rubber ball filled with water. A few days before her labor began I made an internal examination with little satisfaction. Fetal heart sounds could not be heard. I could feel a movement, but did not know what part moved. A twin pregnancy was thought of, but I am sorry to say I did not make any abdominal measurements. Aside from the large size and the discomfort it caused her the pregnancy seemed otherwise normal. July 5, 1902, while at the supper table, without warning or severe pain her membranes ruptured and a gush of liquid passed from her. Her husband and sister claim not to exaggerate when they say that fully one gallon passed. From my own observation, there must have been an abnormal quantity as her clothing and the bedding were saturated. At 8.30 P. M. she had moderate pain, and also felt somewhat prostrated. The fluid was still escaping, which continued until the labor was over. At 9 P. M. a digital examination showed the uterus high and the abdomen large. The feeling of prostration was somewhat relieved by the use of an opium suppository. About 10 P. M., pains became regular and were stronger, lasting longer and increasing in frequency. An examination at this time proved more satisfactory as I could map out, with some difficulty, what seemed to be a breech presentation. At 10.30 there had been so little progress and the prostration was so extreme that I decided to call the assistance of Dr. Frank White. Forty-five minutes after his arrival I delivered her of a male child. It was under size, animation low, weight $2\frac{1}{2}$ pounds and was with much difficulty

resuscitated. With this birth a large amount of fluid also escaped. The child was wrapped in a warm blanket, and sent from the room; it lived 3 weeks.

From the size of the abdomen it was evident that another child was to be born; accordingly a vaginal examination was made and the foot of a child *in utero* was easily felt. As the pain at this time had ceased, and as the mother objected so strenuously to any further examination, it was thought best to give her chloroform. Anesthesia began at 2 P. M. After she was anesthetized her hips were brought to the edge of the bed and a careful examination made. The foot of a child could easily be felt; the cervix was soft and dilated, but there seemed to be uterine inertia. After considerable time both feet were brought down, and by considerable traction the limbs were finally delivered. Careful but continuous traction failed to bring the child any farther. It was soon found that the child was locked somewhere above the pubic bone, and it was also noticed that the limbs were lifeless, cold and colorless. As the woman made no effort at expulsion, when traction was made, and as she was fully anesthetized, Dr. White gently passed his hand into the vagina. Gradually the fingers were worked upward along the back of the child and immediately after passing above the sacrum a beginning prominence of the back could be felt. Dr. White was able to pass his hand up to about where the neck of the child should have been. The enlargement was tense, a feeling of fluctuation was present, it was smooth and fixed. In trying to pass his hand to the fundus of the womb a sudden rupture took place and a large amount of thin, straw-colored fluid escaped along his arm. Afterward the monstrosity was loosened and delivered without further trouble. A very slight tear of the mucous membrane of the vagina took place during delivery. The placenta was large with no white spots or abnormal looking places in it. The cord of the first child was small, long but thin. It was attached near the center of the placenta; the cord of this one about half way between the center and the right border. The membranes were normal. Her lying-in was very good, no fever nor trouble of any kind, except an abundance of milk. The circumference of the upper part of head was 12 inches (5 hours after birth); anteroposterior diameter of right side 9 inches, left side 7 inches. It was 13 inches long; forearm 3 inches, thigh 5 inches, calf 3 inches in circumference. Dividing this monstrosity into two divisions it presents the following points of interest: The anterior superior portion is globular in shape; its contour is regular, with many little sulci in the skin. The skin is somewhat soft and of doughy consistence, but on deep pressure gives a feeling of resistance as though it were cartilage. In the center of this mass there are found little depressions, and 2 or 3 papillæ. The scapulæ and clavicles are wanting. The arms are thick and chubby with one bone in each; the right hand has the normal number of fingers, but the left has 3 only. An opening made near where the clavicle should be shows a cavity which is irregular in shape, the deepest and widest portion being in the center. The thoracic viscera are absent. There was no diaphragm, but below its usual position the intestines are found, but are small and cord-like. Both kidneys are present; the left being particularly low in the abdomen. The liver and spleen are absent. The stomach is a simple dilated portion of the intestinal

tract. The sex is male, but the testicles are undescended. The legs are apparently normal; the feet are in a position of talipes varus. The right foot has 4 toes, the left 3 with a supernumerary toe. The posterior portion shows a much distended, thick, fatty skin substance, leading when opened into what should be the cranial cavity. In this locality nature has formed 4 or 5 cavities of irregular shape, 2 of which are of fair size; the others are smaller and their cavities of less depth. Nothing abnormal is found posteriorly below the mass of flesh. There were no brain, spinal cord, heart, lungs, bloodvessels or blood in this monstrosity. It had a number of short stiff hairs on the top of it which became soft after the gelatinous substance oozed.

DISCUSSION.

DR. ELIZABETH PECK said that she believes that the ridges on the skin in the upper part of the body are nature's attempt at cerebral development. Owing to the stage of development that the fetus has reached, she feels that it is hardly credible that there is no central vascular system, and inclines to think that some form of heart must be present, probably tubular in shape. The prenatal history of the mother and her present somewhat lowered mental status, as indicated by her abnormal tendencies, such as eating paper, etc., possibly had an influence in producing this abnormal fetus.

DR. ANNA M. REYNOLDS, in closing, said that, although she carefully examined the monstrosity for signs of a heart and bloodvessels, she is positive that neither are present in any form, as there is absolutely nothing above the area in which the diaphragm is normally situated. There was no blood. The skin appeared distended with a peculiar gelatinous liquid about the consistency of blood. She said that the first child born was well-developed, but looked like a premature child. The labor was about 3 weeks earlier than was expected, the early termination of the pregnancy probably being caused by the polyhydramnios. There was no attempt at abortion, the mother being very desirous of having a child. I am indebted to Dr. Frank White for his kind assistance in this case.

Two Cases of Perforation in Typhoid Fever with Inconclusive Symptoms.

BY JAMES HENDRIE LLOYD, A. M., M. D.,

and

THOMAS L. COLEY, A. B., M. D.

[Read December 23.]

The two cases which we now report present examples of the difficulties of definitely determining the onset of perforation in the course of enteric fever. It is well known and often emphasized that the so-called classical symptoms of perforation are wanting in conclusive

detail in a large percentage of cases. In some patients, however, these symptoms are present and yet no perforation is found through the surgeon's exploratory incision.

Statistics show that perforation occurs in 3 per cent. of all cases and in 30 per cent. of fatal cases. The fact that by early surgical intervention there is hope of saving at least one-third of the cases of perforation, has brought into prominence the necessity of being able to recognize perforation as soon as it occurs. We can imagine no more hopeless task for a young interne than his efforts to seek material help from his text-books in a given case of typhoid under his care in which he sees that something has gone wrong and suspects perforation. It is the rule in works on medicine to describe the symptoms of perforation simply as those of collapse and the symptoms of peritonitis. We quote the following description from a well-known work and it is far more satisfactory than that given in some twenty text-books consulted. "The symptoms of perforation are due to the resulting peritonitis and are usually well-marked and characteristic. The occurrence of perforation is indicated, as a rule, by the sudden onset of pain in the abdomen accompanied with symptoms of collapse. The abdomen becomes distended and rigid with marked tenderness on pressure. The pulse is small and rapid and there is frequently a temporary fall of temperature. Vomiting is common, the face grows pale and pinched and the breathing thoracic. If the peritonitis becomes general, the signs of prostration increase and the patient gradually sinks into collapse." (J. W. Brannan, in *Twentieth Century Practice*.)

Such descriptions, however they may fit certain cases, are inadequate in that it is common experience to encounter perforation in the absence of some or of all the cardinal symptoms. Osler has put the matter very tritely, in stating that the symptoms given as those of perforation are but the symptoms of the resulting peritonitis. Cushing states that no abdominal symptoms, either subjective or objective, occurring in the course of the fever, should be regarded as trivial, and a sudden change of any sort in the patient's condition should lead, first of all, to the suspicion of this most serious complication. A distinction should be drawn between the two varieties of perforation, the appendicular and those occurring in the free bowel, and their symptoms, course, and prognosis vary considerably. Many cases, however, even those of perforation in the free bowel, present what may be

recognized as a preperforative stage, which in some cases calls for a laparotomy, in anticipation of a complete perforation with extravasation. The presence of leukocytosis is not an infallible sign of perforation, as it may disappear with the onset of general peritonitis. It is most valuable in this anticipatory stage.

Osler, among others, does not believe that it is possible to do much with what Cushing has called the "anticipatory" or "preperforative stage." It is doubtful whether perforation *per se* presents a single constant symptom apart from the acute peritonitis which is always the *immediate* result of such a complication. Further, cases are recorded in great numbers in which the perforation did not produce even the typical symptoms of peritonitis. This fact has impressed itself upon a number of clinicians and in this connection we would quote G. P. Yule (*Edinb. Medical Journal*, April, 1899), who reports ten cases of perforation in typhoid fever. In his experience the onset is likely to be gradual in many cases. Only one of those cases reported showed violent onset. The distension that commonly follows may be postponed for hours. There may be but little change in the pulse and no severe pain, and the patient may take nourishment freely. Under such circumstances there may be an entire lack of the usual, anxious expression, the position may not be typical, and in general, it may be extremely difficult to determine that such a grave complication has arisen.

A. McPhedran (*Philadelphia Medical Journal*, March 3, 1902), also observes that the diagnosis of perforation in typhoid fever is sometimes extremely difficult. He describes two interesting cases. The first patient had been treated for syphilis, and was taking potassium iodide. He had some indisposition, which was attributed to disturbance of digestion by the iodide. He had no fever and his pulse was normal, but later he had pain in the abdomen, and there was evidently some fluid in the peritoneal cavity. Death occurred, and necropsy showed two small typhoid ulcers in the ileum, one of which had perforated. This was a strikingly mild case of apyrexial typhoid without any evident symptoms of perforation. In his second case, the man was evidently in the midst of an attack of typhoid, and he had pain without any definite signs of perforation; but since there was persistent tenderness of the abdomen, he was operated upon, and a perforation was found, almost completely walled off. The man died. Persistent pain is considered the most constant symptom of perforation.

Osler says (*Philadelphia Medical Journal*, January 19, 1901), that perforation occurs, as a rule, in the more severe cases and during the height of the disease. The rare cases during convalescence need scarcely be considered. Cases with diarrhea and with tympanites are more liable to this accident. Of the thirty cases he discusses, twenty had diarrhea; sixteen at the time of perforation, four had constipation at the time, and in ten the bowels were regular. In one it is not mentioned. There is an interesting group (six cases) of perforation with hemorrhage. "When we remember" (we are quoting verbatim), "that a large proportion of all cases of typhoid fever if left alone have no abdominal symptoms—neither diarrhea, pain nor tympanites—it is not difficult for the attendant to keep his mind constantly on the alert for the danger signal." However alert the physician may be in watching for danger signals in his severe cases the fact remains patent that there is no single infallible symptom of perforation. The condition is frequently not discovered until the patient is at the threshold of death from diffuse peritonitis. The earlier the complication is discovered, the greater the hope of surgical intervention. Cushing has mentioned an important point in this connection (*Annals of Surgery*, May, 1901), "One reason that better results are recorded from operation during the period from eight to twenty-four hours after perforation, is that patients surviving the perforation for so long a time have a milder infection or the process has been slow enough to permit a combative reaction."

We have mentioned the fact that patients have been operated upon presenting the typical symptoms of perforation, in other words, of diffuse peritonitis, in whom no perforation has been found. Liebermeister, writing some thirty years ago, in Ziemassen's *Cyclopedia*, mentioned the occurrence of peritonitis without perforation. Recently Mannini (*La Riforma Medica*, 1900, Nos. 210 and 213), has presented an admirable explanation of this condition, which is not at all an unfamiliar one, but which seems worthy of proper emphasis. Mannini directs attention to the fact that in typhoid fever the intestinal epithelium has lost much of its protective power, that the lymphatic apparatus is inflamed, and that bacteria evidently pass the intestine, as they are found in the spleen, the liver, the kidneys and elsewhere. It is rather remarkable, under these circumstances, that peritonitis does not occur very frequently, as the bacteria undoubtedly reach the peritoneum also. The explanation of the infrequency is to be found

in the fact that the peritoneum absorbs very freely and gets rid of the bacteria in this way, and also the peritoneal fluid and the leukocytes contained therein have a strong bactericidal action upon various organisms, including the typhoid bacillus. In a certain number of cases, however, peritonitis does occur without perforation, and must in such cases be attributed to diffusion of the bacteria through the intestinal wall, the occurrence of peritonitis being due to loss of the normal resisting power of the peritoneum. The only point distinguishing this form of peritonitis from perforative peritonitis is the fact that, in the latter, air may usually be shown to be present in the peritoneal cavity.

The two cases which we wish to place on record are as follows:

The patient, A. L., an Englishman, aged 52 years, a butcher, was admitted to the wards of the Methodist Episcopal Hospital in the service of Dr. Lloyd on October 30, 1902. He had used alcohol moderately. There was no history of venereal disease. He said that he had had most of the diseases of childhood but never suffered from typhoid fever. He had a right oblique inguinal hernia. About October 24, 1902, he was seized with intense headache, diarrhea and vomiting. The symptoms grew worse each day and were especially aggravated at night. He was examined on admission to the hospital, October 30, 1902, by Dr. Harlan Shoemaker, the medical resident, who observed that he had marked tenderness and gurgling in the right iliac fossa. A few rose spots were observed. His temperature on admission was 103.8°. The patient had had no cough whatever. Examination of the heart and lungs was negative, as was the examination of the liver and spleen. There was a moderate degree of tympany present which it was thought might have obscured the splenic enlargement. The postmortem records, however, show that the spleen weighed but 6 ounces and was firm and friable. The urine yielded the diazo reaction. The Widal reaction was positive. From the date of his admission, October 30, until November 6 his temperature was kept below 103° by tubbing. At noon on November 6, after taking milk, the patient grew deadly pale and vomited. With these symptoms he was seized with an acute agonizing pain in the epigastrium. There was moderate tympanites but liver dulness could be made out. Soon the pain changed in character and became dull and boring. He vomited frequently and was unable to retain any nourishment by the mouth. At 12 o'clock, November 6, the time of the sudden onset of pain, his temperature was 100.2°, respiration 30 and pulse 88. At 9 A. M. it had been 100.6°, with pulse 84 and respiration 88. This was the 13th day of the disease. At 3 P. M., his temperature 102.2°, with respiration 30 and pulse 84. At 4 o'clock it was 103°, at 5 o'clock it had dropped to 102°. Leukocyte counts were made during the afternoon by Dr. Shoemaker and are recorded as 7,600, 8,000, 7,200, and 7,800. The abdomen became board-like in its rigidity and the pain continued. At 11 A. M. on the 7th Dr. John B. Roberts saw the patient in consultation with Dr. Lloyd. On the morning of the 8th a previous

rectal examination having proven the rectum empty, a high saline enema was given and 15 to 20 hard scybalous masses of feces were passed. His condition remained about as stated with the patient growing gradually weaker until the 11th, when the symptoms became worse. His pulse increased in frequency and his temperature rose. No nourishment could be retained. The abdomen was board-like and the patient complained of great weakness and said he felt death approaching. Toward noon of the 11th the tympanitic conditions of the abdomen had increased greatly. At 6 P. M. there was projectile vomiting and death ensued. A feature which the resident has carefully noted in this case is the fact that from noon of the 6th, the time of the onset of the sudden pain, the excretion of the urine diminished $\frac{1}{2}$. He had voided 64 ounces on the 5th and but 20 ounces on the 10th. The autopsy was performed at midnight, 6 hours after death, by Dr. C. B. Farr, the pathologist of the institution. He has kindly furnished us with the following notes. "The post-mortem rigidity very marked. Slight emaciation. Abdomen moderately distended. On opening the abdomen the coils of the intestines seem to be united by delicate bands of adhesions which are readily separated. This condition is more marked in the lower abdomen. Considerable clear fluid occupies the peritoneal cavity. The parietal peritoneum is markedly injected and there are flakes of lymph here and there. On separating the adhesions below, the pelvis is found to be filled with turbid, yellow fluid having a slight fecal odor. The appendix is short and adherent at its apex by recent adhesions. On following up the ileum from the ileocecal valve it is found to descend into the pelvis, where it is fixed by easily separable adhesions. Nine inches from the ileocecal valve a perforation $\frac{1}{8}$ inch in diameter is found. About this is a zone of congestion and around this a few torn adhesions. On the mucous surface is an irregular transverse sloughing ulcer about $\frac{1}{2}$ by $\frac{3}{4}$ inch in its dimensions. The edges are elevated and the base is formed by the muscular coat although a considerable area about the perforation is denuded down to the peritoneum. There are numerous other ulcers also transverse in the adjacent parts of the ileum. None of them, however, extend deeper than the muscular coat. The small bowel above the perforation is greatly distended and contains fluid feces. The large bowel, especially the lower half, is empty and collapsed. There are no ulcers in the colon. The stomach is normal in size. There is a small pouch just admitting the tip of the thumb $\frac{1}{2}$ inch above the pylorus. The mucous membrane of the fundus is congested (this is probably hypostatic). The esophagus contains no ulcerations. The spleen is not much enlarged, weighing 6 ounces; it is firm and friable. The kidneys appear normal with the exception of a slight narrowing of the cortex. The capsules are not adherent. The gall bladder is distended, but the bile ducts are patulous. Recent perihepatitis is present. The liver weighs 82 ounces and is very friable. The heart is firmly contracted, the muscle firm and there are no valvular lesions. There are a few small yellow areas of atheroma above the aortic valves. There are no pleural adhesions. The lungs are crepitant throughout. There is a slight hypostatic congestion posteriorly."

In this patient we call attention to the fact that the fever from its onset was not regarded as severe. There was no difficulty in con-

trolling the temperature; there was neither diarrhea (not more than two stools in the twenty-four hours), nor more than a slight degree of tympanites. The patient had complained from the first that he disliked milk, but no symptoms followed its ingestion until noon on the thirteenth day of the disease when occurred the sudden attack of pain with vomiting. This the patient felt was due to the milk he had just taken and he stated that while he had not vomited previously after taking milk he had several times been nauseated. We have called attention to the fact that with the onset of the pain there was neither a drop in temperature, nor appreciable change for forty-eight hours in the pulse or respiration. Further with the increase of tympanites following the complication the liver dulness could be well made out, and there was no exquisite or even general pain on abdominal pressure. The leukocyte counts which were made during the afternoon of the day in which the pain occurred varied between 7,200 and 8,000. It is questionable whether these figures should be regarded as a leukocytosis, even admitting the leukopenia which is present in typhoid.

A. S., aged 36 years, laborer. Admitted November 11, 1902. Patient is a laborer and has done hard work out of doors. There is a history of specific urethritis. He has used alcohol, but not to excess. Patient does not know whether he had the usual diseases of childhood, or not. Never suffered from typhoid fever; has had acute rheumatic fever. Present illness began 5 weeks ago with a heavy cold. Since October 21 has had headache, fever, coated tongue, loss of appetite, diarrhea, and still suffers from these symptoms. He has a severe dry cough. On admission, patient was not delirious. Temperature was high (104.6°). He has been on his feet occasionally until 2 days before admission. The patient's face is not flushed. The tongue is coated and breath offensive. Examination of the lungs is negative. Heart—there is a systolic murmur at the apex and a reduplication in the pulse. The heart outline is normal. There is no thrill. The spleen is slightly enlarged, palpable and not tender. Abdomen is flat and slightly painful on pressure. Two roseolar spots are seen. November 17, patient's abdomen is tympanitic. November 18, roseolar eruption is now profuse over the trunk and a few spots are seen on the thighs. About 11 P. M. the patient vomited the nourishment which had just been taken. There was no complaint of pain. At 8 P. M. his temperature was $101\frac{3}{4}^{\circ}$, pulse 100, respiration 20. After the vomiting, at 11 P. M., the temperature was 100° , pulse 120, respiration 44—a significant change in respiratory rate. Tympanitic condition of the abdomen has increased. The patient talks in his sleep and when aroused complains of pain over his whole body. When questioned about this pain he states that it is a general soreness, as if he had been beaten. November 19,

patient vomited nourishment at 3 A. M. No complaint of pain of localized character, but the patient states that there is a general abdominal soreness. At this hour his temperature was 102°, pulse 116, respiration 36. At 2 A. M. the temperature was 104.8°, with pulse at 120 and respiration 44. At 5 A. M. the temperature was 103°, pulse 128, respiration 24. At 6 A. M. the patient was sweating, temperature 102.6°, pulse 128, respiration 28. Dr. Roberts saw the patient at 8 A. M., about 5 hours after perforation was suspected, but did not regard the symptoms as sufficiently conclusive of perforation. Leukocyte counts made at this hour were 5,733 and 5,800. The patient had 2 large, loose movements of greenish color which contained many curds. At 12 o'clock, his temperature was 102°, pulse 124, respiration 28. The patient was operated upon by Dr. Hutchinson at 3 P. M. Four large perforations were found and the abdominal cavity was filled with fecal accumulation. The perforations were closed, the abdomen thoroughly washed with normal saline solution which was also used intravenously during the operation. Death ensued in 24 hours.

This patient was admitted on what appears to have been, from the history, the twenty-first day of the disease, November 11, 1902. There was a higher degree of pyrexia than in the first case, the temperature several times reaching 104.6°. This was readily controlled by bathing. As in the first case, the patient continued fairly comfortable and did not have more than two bowel movements in twenty-four hours. The tympanites, in this case, however, while moderate in degree, was greater than in the first case. The onset of vomiting was at 11 P. M., November 18, at which time the temperature was 100°, respirations 44, pulse 120. At 8 P. M., as was mentioned, the temperature was 101.6°, pulse 100, respirations 20. At 2 A. M. the respirations and pulse remaining the same, the temperature had mounted to 103.8°. At 3 A. M., the time of his second spell of vomiting, temperature was 102°, pulse 116, respirations 36. The general character of the temperature curve was very similar to that of twenty-four hours before with the difference that at that time the respirations were 20 and the pulse 88 and 90 respectively.

The presence of extensive perforations and fecal accumulation in the abdominal cavity is a fact of which the symptoms we have detailed gave small indication. We have reported these two cases with the hope of calling to mind the grave responsibility which attaches itself to the physician in every case of typhoid fever. There is great need of extended observations in cases of this sort in which the early recognition of perforation is imperative if the patient's life is to be saved by surgical means.

leads me to the following conclusions: The occurrence of pain and the increased rate of pulse and respiration are probably the most valuable early diagnostic symptoms of perforation. The count of leukocytes seems to have little value, unless it be hereafter proved that a count of the number of polymorphonuclear leukocytes has diagnostic significance. A sudden fall in temperature is not a necessary accompaniment of perforation.

DR. JAMES P. HUTCHINSON said that he believes that in the majority of cases it is impossible for either the surgeon or the physician to demonstrate conclusively the existence of perforation in the early stage, and that to delay operation until a positive diagnosis can be made will be followed by fatal results. Out of 10 cases which he has studied in the past 8 months, 7 of which he has operated upon himself, but 2 presented the fulminating type of the disease, in which there was no doubt of the diagnosis from the start. All of these cases presented symptoms of interest. They all had pain, which was generally most marked with what was presumed to be the onset of the perforation, sometimes, however, progressively increasing. There is, as a rule, a changed facial appearance; the abdomen is painful, although not constantly so, the seat of the most marked pain usually being the epigastric region, but in one case which he observed it was on the left. Abdominal distension existed in 6 out of 10 cases; but in 2 of them there was at least a quart of fecal accumulation, without distension; the abdominal wall was tense in every case. The leukocyte count, as a rule, is of some assistance; but in these cases, with one exception, there was no marked increase in the leukocytes; in that case they numbered 11,000. The pulse in every case was weak and thready, and the temperature rose and fell with about equal regularity; in 5 cases there was from 1 to 4 degrees increase in temperature and, in about an equal number, about the same extent of decrease. In 2 cases there was hemorrhage from the bowel, immediately following the attack of pain. In any case in which there is a reasonable doubt as to whether or not a perforation exists, operation is recommended, the perforation closed, and the abdomen thoroughly flushed out with normal salt solution. He feels that in a certain number of cases not operated on, nature will effect a cure. In 2 of the cases on which he operated an effort at repair had been made and, in the case which he operated on for Dr. Lloyd, one of the perforations was entirely occluded with omentum. While some cases may be operated upon when perforation is not present, it is probable that the majority of fatalities are not due to the result of the operation, but to procrastination in delaying surgical intervention. To his knowledge, in 3 cases in which operation had been performed and no perforation found, there had been a distinct amelioration of the symptoms for 36 hours; in each case the abdomen had been flushed with normal salt solution, and in each there was a distinct drop in the temperature and a distinct remission of the symptoms for 36 hours, after which the typhoid fever continued its ordinary course; all of these cases recovered. In the 10 personal cases reported, although the mortality is high, in every case there was a distinct improvement after the operation; there was less pain, and in those cases in which there had been abdominal distension there was a distinct improvement in this condition, although many of the cases finally succumbed to their already

septic condition. In conclusion he said that, while he does not believe that every case of typhoid fever that shows the slightest symptoms of perforation should be operated upon, he feels that the trend should be in that direction, as he believes that this procedure assists in every case, and in those cases in which perforation is actually present, he considers it practically the only cure. While there are a certain number of recoveries reported in which operation had not been done, the number is comparatively small and he feels should not be taken into consideration in deciding for or against surgical assistance. In regard to the statement that a delay of 24 hours in operating is practically fatal in these cases, he feels that this is an error, as in the first case he had operated upon the perforation had existed for at least that length of time and feces were present in the abdominal cavity. Several of the cases of successful operation which he had seen were cases in which feces were found in the abdominal cavity, while he had lost 2 cases in which no feces were present. One of the most important factors in the diagnosis is the drawn, gray appearance of the face, which was particularly prominent in the patient he operated on for Dr. Lloyd. He has never operated upon a case for perforation in which perforation was not found, although some time ago he advised an operation on a patient at the Pennsylvania Hospital, which was not done, and at the present time the patient is apparently improving. This patient probably did not have typhoid perforation. In Dr. Lloyd's case he feels that there were 2 stages of the condition, in the first perforation the omentum completely occluded the opening, but later, a leakage of feces occurred around the seat of this attempt at repair and other perforations occurred.

DR. JAMES HENDRIE LLOYD referred to the seemingly remarkable tendency to perforation in cases of typhoid fever occurring in Philadelphia during the present fall, 5 cases of this complication having been observed at the Methodist Episcopal Hospital alone, 2 of which occurred in his service, being the cases reported in the paper just read. The difficulty of making a positive diagnosis of perforation and the importance of early operation in cases in which the condition is present, were commented upon. In regard to the first case reported in the paper, he said that he felt that the case was a dubious one from the start, and while the symptoms were suspicious at the time of the first consultation held with Dr. Roberts, neither at that time, nor at the time of the next consultation, 24 hours later, were they sufficiently grave or sufficiently marked, positively to indicate operation. In regard to the theory, advanced by Dr. Roberts, that operation is inadvisable after 24 hours from the time of the perforation, he feels that if the symptoms are so mild and so indistinctly marked, if there is so little evidence of shock, if the patient is in such general good condition, and with such freedom from all severe symptoms that a positive conclusion cannot be reached at the end of 24 hours, and then if a positive diagnosis can be made at the end of 36 or 48 hours, operation should be done at this late hour, as the very fact that the symptoms had been so mild at first would indicate that the patient is not too seriously ill for operation and that there is not much diffuse peritonitis. In regard to the second case, he feels that an examination of the chart would reveal one of the most graphic exhibitions of what takes place in perforation in typhoid

fever that could be imagined. At 3 A. M. there was sudden onset of pain in the abdomen, and within an hour the respirations rose from 20 to 44, and the pulse from 96 to 120, and the patient became pallid, although there was but slight change in the temperature. These symptoms, he felt, showed a condition of collapse indicating perforation. The operation on this case, which was performed by Dr. Hutchinson, revealed a large sloughing perforation and several smaller perforations, and the speaker felt it was a very hopeless case from the surgical standpoint, although the operation was performed in less than 12 hours after the onset of the symptoms. In regard to the cases reported as recoveries without operation, he feels that a great many of these are probably instances of mistaken diagnosis, the real trouble probably being some indigestion during the convalescence from the typhoid fever. In the doubtful cases he recommends operation, even late in the case, as this offers practically the only hope of recovery if perforation exists.

DR. HERMAN B. ALLYN said that, while the cases reported by Dr. Coley and Dr. Lloyd indicate that it is impossible to recognize perforation in a certain group of cases of typhoid fever, yet this is not true of all the cases. The hospital physician is at a disadvantage, because he cannot have personal knowledge of the patient's temperament and surroundings, and the sort of an outcry he will make under a certain amount of pain, which one in private practice has. Pain should not be looked upon as a constant or even a common symptom of typhoid fever, and when it is present careful search should be made for the cause. By studying carefully the patient, the character of the pain, the condition of the abdomen and the character of the symptoms, much assistance in diagnosis can be secured. Leukocytosis is absent in half the cases of perforation in typhoid fever; and in fact there is no symptom of perforation that may not occur when perforation is not present. Pain and tenderness are the most constant symptoms.

DR. JOHN B. ROBERTS said that the reason he advised against operation in the first case he saw with Dr. Lloyd was first, that it was doubtful whether perforation had occurred; and second, that it was doubtful, if perforation had really occurred, whether operation would be of any value at that time. He did not believe, however, that the mere fact that operation had been delayed for 24 hours, should preclude surgical interference, if a diagnosis of perforation could be made with reasonable certainty.

DR. T. L. COLEY said, in closing, that in his opinion Dr. Roberts and Dr. Lloyd had done well to emphasize the change in respiration rate in the second case from 20 to 44 within 3 hours, which was coincident with the attack of vomiting and the probable onset of perforation. He believed, however, that the act of vomiting could hardly occur, leaving perforation quite aside, without a temporary increase in the frequency of the respiration and it might be well to recall that vomiting, while a symptom of importance, did not always mean perforation. He referred to the use of infiltration anesthesia by many operators in the treatment of intestinal perforation in typhoid fever. These surgeons claim that much less deleterious postoperative effects follow this method than that of general anesthesia.

The Physical Signs and Symptoms of Gastroptosis.

BY ALBERT P. FRANCINE, A. M., M. D.

[Read December 23.]

One may often make the diagnosis of gastroptosis from a comparatively superficial examination of the abdomen. In thin subjects of weak bony and muscular development, a fair idea of the position of the stomach may frequently be made out by inspection and percussion, unaided by inflation of the organ. In typical cases of gastroptosis the chest is long, the costal angle acute, the interspaces wide and the abdomen pendulous or relaxed. Upon inspecting the abdomen of such a patient in the recumbent position, there may be observed a flattened area in the epigastrium immediately beneath the xiphoid cartilage; while an area of prominence corresponding to the altered position of the stomach, or, in thin subjects, the outline of the stomach itself, may be noted.

It is not always, however, as simple a procedure to outline the position of the stomach in gastroptosis as a limited experience might lead one to suppose. This is particularly true where there is much relaxation of the abdominal walls. Rarely, under inflation, the stomach may dilate and seem to occupy the whole abdomen at one examination; while at another, under the use of less air or by its premature escape into the small bowel, it may seem to occupy a much smaller area or even a different position altogether.

The method of examination suggested by Runeberg, of inflation with air through the stomach tube following lavage, should be employed. The older method of Frerick in which CO_2 was used has served its turn and been discarded. Its serious disadvantages need not be mentioned here; while Einhorn's gastrodiaPHONE and Turck's gyromele, have more to discountenance than to recommend their use. After inflation, percussion is the simplest and, in the author's experience, the most accurate method of outlining the size and position of the stomach. Auscultatory percussion is preferred by some.

In gastroptosis the lower curvature of the stomach is below the umbilicus, sometimes as much as a handsbreadth. Frequently the umbilicus is the center of a three-quarter circle formed by the boundaries of the ptosed and dilated pyloric extremity of the stomach; while the cardiac end remains approximately in its normal position.

In inflating the stomach with air the size of the viscus is exaggerated, and the lower boundary may reach a half inch below and the cardiac end may rise an inch or more above what may strictly be considered its true position. It is possible, as thought by Turck, that under inflation the stomach revolves on its longitudinal axis, and the greater curvature is thus rolled out against the abdominal wall. These points should be borne in mind, though they hardly count against the usefulness of this method, as a normal stomach always remains normal and various grades of change in position and size can thus be noted, albeit with these reservations in mind.

The position of the colon is more difficult to determine than that of the stomach, but inflation with air through the rectum may be practiced. The difficulties and doubts of this procedure are many, though by it the transverse colon and the hepatic flexure may usually be mapped out. The splenic flexure lying, as it does, behind the cardiac end of the stomach eludes demonstration. From post mortem records, and the position of the colon as determined by laparotomies, it would appear that the transverse colon is always ptosed and that it assumes the U or M shape. Frequently it lies in the true pelvis some distance below the greater curvature of the stomach. Inflation causes it to rise so that it will usually be found to follow closely the greater curvature of the ptosed stomach. The flexures may be in place, though the hepatic flexure frequently sinks to the level of the umbilicus. Ingalls, of Cincinnati, in a patient operated upon by him found the hepatic flexure of the colon in about its normal position, while the splenic flexure was ptosed, the principal disturbance being from the median line to the left. The reverse of this is usually the case.

The right kidney in women is frequently movable (in sixty of one hundred cases in my series), more rarely both kidneys (in twelve out of one hundred) and very exceptionally the left kidney alone. Einhorn, out of 1,912 patients, 347 of whom had gastroptosis, found the left kidney movable in six. Other observers of large experience, like Edebohls, Roskam and Reed, have not observed this latter condition. With regard to the best position for palpating the kidney, that usually employed with the patient in the supine position with the legs flexed, is the best, though the upright position with the body bent forward (recommended by Noble) may be tried. Getting the patient to cough or turning her on her left side may serve to render a kidney palpable,

which is not so in ordinary deep inspiration. Occasionally a movable kidney can not be palpated after the patient has been in the recumbent posture for a moment or two, and, in addition to the other ordinary sources of error, care must be observed not to mistake an anomalous position of the sigmoid flexure for a movable kidney as was done in a case operated upon at the University Hospital.

Diastasis of the recti muscles as described by Webster, is an important sign, and should be looked for. It occurs in the great majority of multiparous women. It does not occur, or with extreme rarity, in nulliparous women, nor in men.

The blood, except for a mild secondary anemia in some patients, is negative, as a rule, though there may be an associated condition of chlorosis; this latter was present in three of one hundred patients. Examination of the gastric contents following a test meal usually reveals a condition of subacidity. The total acidity is often reduced to fifteen in terms of a decinormal sodium hydroxide solution, the free HCl being frequently almost or totally absent. Occasionally hyperacidity due to an increase in the normal acid is pronounced. There is usually in these latter patients marked gastrectasis or a strong neurotic taint. Lactic acid is rarely if ever present. The urine, except in bad cases where there may be an increased elimination of the ethereal sulphates and the presence of oxalates, indicative of gastro-intestinal fermentation, is negative.

The presence of a floating tenth rib has been pointed out by Stiller as pathognomonic of this condition. It would be conceivable that the relaxation of the diaphragmatic attachment thus brought about might possibly entail some of the far reaching and numerous consequences detailed by that author, but the significance of this stigma would seem to consist in indicating the type of individual, who through hereditary weakness or anomaly of both osseous and muscular structure is constitutionally predisposed to abdominal ptoses. A floating tenth rib is, however, in the author's experience, so infrequent an occurrence as not to warrant great stress being laid upon it. In my series of one hundred cases it was noted in but five.

Much the same estimate may be made of the splashing sound, which no less an authority than Strumpell is inclined to consider very lightly. When properly studied by a skilled observer it may bear its quota of significance, but it is not so much the presence of a splashing sound itself as of its proper interpretation in association with other data that is of importance.

Symptoms.—In studying the symptoms of gastroptosis it should be prefaced that downward displacement of the stomach may exist without giving rise to any symptoms whatever. In these patients it will be found that the motor and secretory functions of the stomach are normal, and therefore, in a sense the significance of gastroptosis, if we limit that term to mean simple ptosis of the stomach, is not clear. But this term connotes more than mere displacement; it connotes the clinical picture which we commonly recognize in the so-called nervous dyspepsia. It is impossible to estimate absolutely the significance of the displacement *per se* in the causation of symptoms, though it would seem highly probable that downward displacement could not long exist without leading to secondary functional disturbance.

It should be recognized then, that the characteristic symptoms of gastroptosis are those of gastric motor insufficiency, plus nervous influences, and that these different elements act and react upon each other. The symptoms of gastroptosis must be considered broadly, and in so doing one cannot overlook the nervous element which plays so conspicuous a part. Strumpell well points out the striking effect of emotion or autosuggestion in gastric disorder or disease, and would suggest the term "gastric neurasthenia" as more nearly implying the constitutional or central character of the symptoms than the more generally accepted one of "nervous dyspepsia."

In cases of the so-called primary gastroptosis the symptoms are usually those of gastric motor insufficiency of a mild grade, consisting chiefly in distress and flatulence after meals. When general dilation exists there is apt to be more retention and consequently more functional disturbance. In these latter cases it is not rare to find severe gastric pain, nausea and vomiting, and the symptoms of more marked auto-intoxication. The primary factor in the production of the fermentation is stagnation of the gastric contents, due to loss of motor power on the part of the stomach. There is pyrosis with distension and flatulence, usually following the ingestion of food, particularly rich, fatty, or starchy foods. The production of gases and the consequent gastric irritability frequently give rise to attacks of palpitation of the heart and dyspnea.

There is usually some acute gastric pain, which may be sharp or burning in character, affecting the pit of the stomach, or sometimes involving the whole abdomen. This pain may be due to an associated gastric catarrh, or to hyperacidity, being usually acute in the former

and burning in the latter condition; or pain may be due, as suggested recently in Germany, to insult to the solar plexus from the dropping of the stomach. There is not rarely an annoying "stitch" in some region of the abdomen, probably due to adhesions.

Pain in the back or lumbar region and a sensation of weight and dragging in the abdomen are frequent symptoms due to evident causes. Headache, weakness, drowsiness and malaise are often present. Constipation is the rule, though constipation alternating with diarrhea, or diarrhea alone may be present. Nausea may be complained of on rising. Vomiting is not usually present unless due to retention of food or to nervous influences. Palpitation of the heart, dyspnea and consequent precordial distress or even pain, is not an infrequent symptom due to pressure from wind. Anorexia may be present, though occasionally a large appetite and thirst are complained of, the latter being more apt to be the case where hyperacidity exists. The tongue is usually coated, and there is some loss of flesh. Symptoms due to impaired circulation are not infrequently noted—like cold hands and feet, a sense of numbness in the extremities, and attacks of dizziness or vertigo. These have been considered as due to cerebral anemia, and to disturbed circulation, especially in the splanchnic area.

In addition there are to be found in many cases symptoms the result of nervous influences or emotion. The clinician who has seen much of this class knows only too well the vagaries and complaints of the gastroptric female. Neurasthenia finds here its choicest spirits.

In those cases in which there is pyloric obstruction, especially if of a severe grade, the symptoms are much exaggerated and should properly be considered as due to the primary factor. In such cases there is great dilation and ptosis, with enormous retention which goes on until the stomach finally rebels and expels its fermenting contents. The stomach may become so irritable as to retain nothing but small quantities of liquid food. The emaciation and anemia are severe and progressive.

Gastric crises, described in 1864 by Dietl, in connection with nephroptosis must finally be mentioned. They consist in attacks of gastric tenderness and pain, attended by a slight rise of temperature and transitory jaundice. Various explanations have been offered for their occurrence, notably as being brought about by torsion of the pedicle of the kidney, as due to kinking of the duodenum; and quite

recently Stengel has suggested that they may be due to direct pressure of the kidney upon the duodenum.

The constitutional and neurasthenic picture produced by malpositions of the uterus is similar in many respects to that produced by gastroptosis, and in the light of our present knowledge it would seem highly probable that many cases which have heretofore fallen into the hands of the gynecologists were in reality suffering from gastroptosis. The author further urges that as both uterine and gastric displacement frequently go hand in hand, more attention should be directed to the stomach in these cases than is commonly done. In many cases the supposed uterine symptoms will be found to have disappeared completely with relief of the gastric condition.

Exhibition of Instrument.

By H. EMERSON WETHERILL, M. D.

At the meeting of the Society held December 10, Dr. H. Emerson Wetherill demonstrated a pocket combination instrument, which he recommended particularly for emergency use, especially in military service. Its value in the hands of the nurse or other person without much experience, for the opening of small abscesses, etc., was commented upon. One end of the instrument is a pair of scissors and the other end a pair of forceps. A needle can be held quite well in three different positions by these forceps, which in one position may be used as a hemostat. The curette on the back of the hemostatic blade is sharp on one edge and dull on the other, so that it can be used for scraping leg ulcers and other similar work. The blades lock in position, so that as long as it is in the pocket it cannot unlock, but it can be freed by a slight twist in the proper direction. It also contains an arrangement for shooting thread.

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